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ANNUAL REPORTS

The Academy of Natural Sciences

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Philadelphia

FOR YEAR ENDING NOVEMBER 30, 1920.

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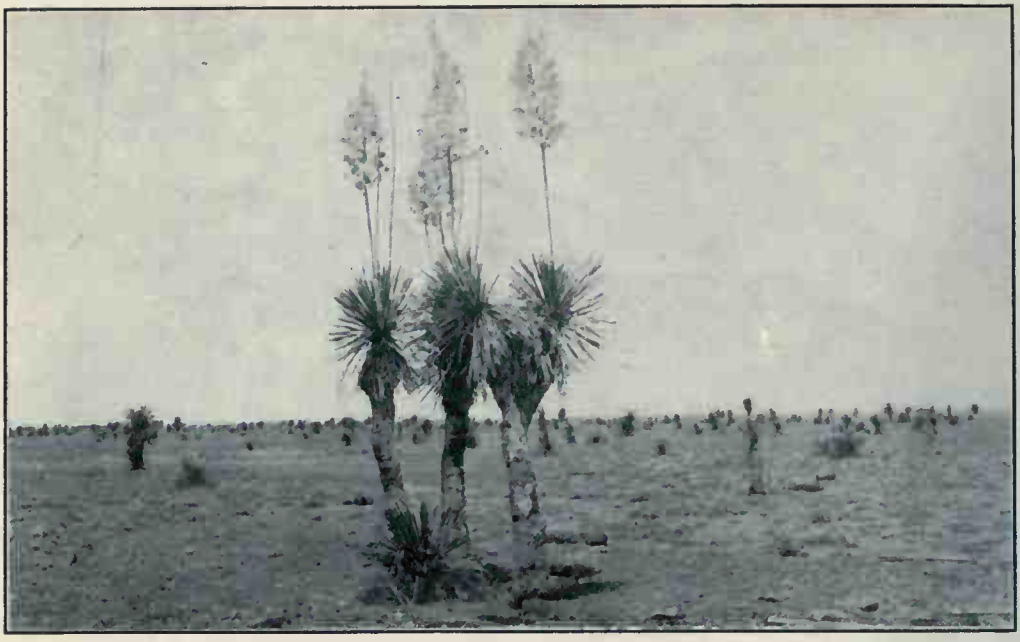

UPPER—Tree Yuccas on the desert between Willcox and the Chiricahuas.
LOWER—Entrance to Pinery Canyon, Chiricahua Mountains, showing oak scrubs in the bottom, scattered vegetation on the slopes, and rim rock on the summit.

Special Reports by Members of the Scientific Staff based on Recent Explorations Conducted in the Interests of the Academy.

EXPLORATIONS IN THE CHIRICAHUA MOUNTAINS, ARIZONA.

BY WITMER STONE, SC. D.

The mountain ranges of southern Arizona present peculiar attractions to the zoologist and botanist in their isolation and the opportunities they afford for the study of the zonal distribution of life.

Rising from the wide spread Arizona desert their highest peaks reach an elevation of eight or nine thousand feet, and in climbing their slopes one passes from a region of cactus and yucca through belts of oak, juniper and pine to splendid forests of Douglass fir and finally bald peaks flanked by aspen thickets, the existence of which would never be suspected by the traveller on the desert but a few miles away. The differences in animal and plant life encountered in the ascent are about as striking as one would experience in travelling from South Carolina to Canada along our Atlantic coast.

The Chiricahuas, in the southeastern corner of the State, had always appealed to me as their botany had not been thoroughly reported upon, while the periodic visits of the thick-billed parrots of Mexico made the possibilities of their bird life interesting.

An opportunity for visiting these mountains came in the spring of 1919 through an invitation from Mr. and Mrs. J. Eugene Law of Berkeley, California, for Mrs. Stone and myself to join them as guests on a camping trip to Pinery Canyon on the western slope of the range.

Reaching Willcox on the Southern Pacific Railroad on the morn-

ing of May 19, we travelled southward on a narrow-gage branch some 20 miles to a little Mexican town, Dos Cabezos, nestling among the barren cones of the Dos Cabezos hills, a crescent shaped northern extention of the Chiricahuas. Thence by automobile we travelled some 35 miles farther across the intervening desert to our destination.

This part of the "desert" is largely composed of hard baked, reddish, clay soil which grinds into a fine dust and in the rainy season becomes a thick, sticky mud, which impedes travel to an extent not dreamed of in the dry, sunny days of spring and early summer.

On the Dos Cabezos hills the only flowering plants were the tall wand-like ocotillos, their stems armed with thorns almost as rigid as steel and bearing on their tops spikes of brilliant red blossoms, shining like tongues of flame in the sunlight. Besides a few tufts of prickly pear (*Opuntia*), there was no other vegetation except the scattered tufts of low prostrate herbs more or less covered with the soil. On the flat stretches of the "desert" there were scattered mesquite bushes and everywhere the low tufted buffalo grasses. The dry washes full of large and small pebbles and banks of sand were bordered by taller yellow grasses, whose lighter colors offered the only relief from the uniform reddish brown that streched away on all sides. Far away ahead of us were the purple masses of the Chiricahuas and on other sides were other more distant, pink and purple mountains, lying farther and father away, and changing from one tint to another as the sun sank lower in the west.

Now and then we passed scattered groves of tree yuccas, hundreds and hundreds of single or branched shaggy trunks surmounted by their prickly crowns of narrow needle-pointed leaves, from the midst of which rose the new flower stalks, at this season closely resembling gigantic "spuds" of asparagus.

White-necked ravens flew from one to another, and an occasional road-runner made off from behind one of the trunks. Scaled or "cottontop" quail flushed constantly from our track and where large patches of Sackaton grass occurred, jack rabbits and cottontails were to be seen scurrying here and there for shelter. Two species of lizards, *Holbrookia* and *Cnemidophorus* ran along the ruts ahead of our car with lightning-like rapidity. As we approached closer to the mountains, vegetation became more varied and great fields of giant white poppies stretched out to meet us, while along the creek that extended out from Pinery Canyon, to finally disappear

in the desert, there appeared a straggling line of trees, mostly Arizona cottonwoods, which became larger and more numerous as we approached the mouth of the Canyon.

Here bird life was very much in evidence. Colonies of Arkansas kingbirds flew from the tops of the cottonwoods with great clamor; here and there a vermilion flycatcher fluttered down through the air like a brilliant autumn leaf as he performed his flight song. Mockingbirds and lark sparrows were in full voice, and Arizona, Bullock's, and Scott's orioles were to be seen in the tree tops.

The bare rounded hills that now appeared on either side were capped by numerous agaves or century plants their great clusters of spiny, fleshy leaves showing conspicuously while their flower stalks, later to tower up like giant candelabra, were now in the same early asparagus condition as those of the tree yuccas, but of much greater diameter and already two to three feet high.

As we entered the canyon, the trail at once began to ascend. A line of rim rock soon loomed above us on either side half a mile or more distant, marking the sides of the canyon, and as we advanced they gradually converged, while the high peaks which had been before us all the while seemed to sink down behind the lower ones immediately before us.

The lower, scrubby oaks looked to an easterner like holly bushes, the leaves being small and of much the same outline, with similar spiny margins. The taller species, with their gnarled trunks and spreading branches reminded one of apple trees, and the scattered oak woods recalled old deserted orchards in the east, though they, like the scrub oaks, have the holly-like leaves. At the time of our arrival the old leaves were all being shed and the new ones just budding so that the ground was covered with a brown and yellow carpet recalling autumn rather than spring.

Conspicuous among the shrubs was the Apache plume with its white blossoms like those of the blackberry and very short linear leaves. Later the clusters of seeds develop long plume like appendages of delicate pink, producing a beautiful effect as the sunlight plays upon the bushes, and reminding one of the mist trees of our gardens.

At a little cabin in the midst of the oaks and close to the rocky stream, which was now nearly dry, we made our headquarters, thanks to the hospitality of Mr. and Mrs. Frank Hands, whose ranch lay a little farther down the canyon and whose brother, then absent, owned the cabin.

Here a large part of our collecting was done and a more delightful camping ground could hardly be imagined. Birds were abundant. Cassin's kingbird and the black-headed grosbeak had nests in the oaks above our tents and the diminutive elf owl, *Micropallas whitneyi*, the smallest owl in the world, came about the cabin in the evening, while Gambel's quail, named after its discoverer Dr. William Gambel a former Secretary of this Academy, ran about in groups feeding among the fallen leaves. Troops of Arizona jays skulked about in the trees ever ready to give warning in harsh cries whenever we sallied forth; ant-eating woodpeckers perched silently on the tops of dead oak trees while at night both the Stephens' whippoorwill and the poor will called continually from just behind our camp.

There were numerous conspicuous yellow composites in bloom in early summer over the floor of the canyon, brilliant scarlet painted cups too and acres of blue lupines, and immense yellow primroses, while in the bed of the almost dry stream grew beds of golden yellow *Mimulus* with large, pale, yellow columbines scattered along the banks. The purple-flowered Arizona locust was the most showy of the trees, though a wild cherry, similar to our eastern species, was also conspicuous, and the great spherical tufts of greenish yellow mistletoe like birds' nests, scattered along the branches of both oaks and pines, at once attracted the attention of a stranger.

Here too, scattered patches of alfalfa in full bloom attracted hordes of butterflies and other insects, and later, when the scarlet Penstemons came into blossom, hummingbirds of several species were almost always present. Late in June we moved our camp some two miles farther up the canyon to an elevation of about 6500 feet, at the end of the old wagon trail constructed by early settlers, many of whom lie beneath rough stone piles in the scrub nearby, victims of the Apaches who found in these mountains their last stronghold. About our tents at this upper camp came birds that we had not encountered farther down, notably the painted redstart, similar in habits to our eastern bird but with a much striking color combination of jet black, crimson-red and white, and the sulphur-bellied flycatcher, both Mexican species which cross the line only in these southern desert mountains.

UPPER—Barfoot Peak 8826 feet, one of the summits of the Chiricahua Mountains. The peak is bare rock flanked by aspen thickets.

LOWER—Caves formerly used by the Indians in the rim rock at the entrance to Bonita Canyon.

From this point the foot trail led to the high peaks, and an hour's climb brought one to a surprisingly different environment.

The oaks and Chihuahua and Apache pines gave way to Douglas fir and Mexican white pine; the shrubs and herbs took on a more familiar appearance, and instead of the strange plants of the desert one found raspberries, strawberries, everlasting, violets, pipsissiwa, larkspur, buttercups, and a brilliant red columbine more nearly like our eastern species.

Of birds these high forests harbored juncos, crossbills, nuthatches, chickadees, warblers of several species, crested jays, and the band-tailed pigeon – similar in a general way to the avifauna of our eastern mountains, though the birds were all different species or slightly different geographic varieties.

As the summer advanced the heavy thunder storms, characteristic of the region, came on. The mornings would be beautifully clear, but about noon the clouds would gather and we would be treated to a terrific cannonading from the heavens. The rain came down in torrents and our little stream which had almost dried up was soon roaring along full to the banks.

Vegetation made great strides and many low herbs which we had found in bloom in May blossomed again in late July. The greatest change however took place on the desert and as we gazed at it, far away, from the heights of Ida's and Barfoot peaks, we could clearly see a green flush spread over it day by day concealing the bare reddish brown stretches of early summer. Later on, in August, when we had an opportunity of studying it close at hand as we crossed it to the railroad, we found numbers of plants that we had not encountered before, mainly growing in dense tufts and mats, and gay with blue, red and yellow flowers, while the long trailing vines of gourds and similar species stretched in all directions like the tentacles of some great octopus.

The collections brought back to the Academy represent nearly all the plants found in Pinery Canyon from the desert to the high peaks at its head which bloom before August 1, numbering somewhat over 1000 sheets (450 species), as well as some 75 species of birds (202 specimens), 15 mammals (40 specimens), 15 reptiles and batrachians (75 specimens), and 650 species of insects (5000 specimens).

The extent of the collection is due in the first place to the generous hospitality of Mr. and Mrs. Law, and to the valuable advice and assistance of Mr. and Mrs. Frank Hands, as well as in no small

degree to the assumption of most of the camp duties by the ladies of our party, affording us every possible opportunity to prosecute our work.

The insect collections have been largely identified. Dr. Henry Skinner has studied the Lepidoptera; Mr. Frank Mason, the Coleoptera; Mr. J. A. G. Rehn, the Orthoptera; Mr. H. L. Viereck, the Hymenoptera; and Mr. W. L. McAtee, the Hemiptera; while Mr. E. T. Cresson, Jr. is at work upon the Diptera. Several new species have been found and quite a number formerly known from south of the Mexican border have been definitely added to the fauna of the United States.

The plants have been largely indentified by the late Stewardson Brown and a report on them is in preparation. As Mr. Law is engaged upon a comprehensive study of the birds and mammals of the Chiricahuas the report upon them has been left entirely to him.

HAWAII REVISITED.

BY HENRY A. PILSBRY, SC. D.

At three o'clock one morning last July, I was leaning over the rail of a Pacific steamer. Let me hasten to add that I am a "good sailor". It was the excitement of again seeing Hawaii and meeting old friends there which robbed me of sleep. Low in the southern sky hung the Southern Cross, and below it a brighter "variable" star, the Molokai Light, against the dark Molokai mountains

My errand was to take part in the first Pan-Pacific Scientific Conference, held in Honolulu during August, and about twenty of my shipmates were delegates from museums and universities of the United States and Canada. Having seen that the islands were still there I turned in, and when I woke again we were off the south coast of Oahu.

Except where irrigated, the shore zone is rather arid. The approach to Honolulu is past austere gray tufa cones, Koko Head, Diamond Head, formed by eruptions of volcanic ashes, the final explosions of the fires below. A thin green line of algarobas[1] borders the shore and straggles up the gullies, with groups of coco palms here and there. With further acquaintance the lower zone

[1] An introduced species of mesquite (*Prosopis*).

UPPER—Rice fields beyond Pearl Harbor, Oahu, the Waianac Mountains in the distance. Here and there stand cocoa palms, reflected in a mirror of silver and pale green.

LOWER—Looking northwest over the Nuuanu Pali (a 700 foot cliff). In the middle distance the precipitous windward wall of the main range rising abruptly from the bare-leveled plain. Kaneohe Bay in distance on the right.

UPPER—Honauau Bay, Hawaii. Native outrigger dugouts hauled up. Among cocoa palms in the distance are the ruins of the great city of refuge of the warlike old times.

LOWER—Cave in a lava flow on the flank of Kilauea. Such caves, often miles in length, are formed by the outflow of hot lava below, after the surface has hardened. Here sections of the roof have fallen.

does not gain much in interest. It is over run with introduced plants. In places the detestable prickly pear and lantana cover the foothills. Introduced species of ants, slugs, the minah bird, and the English sparrow, are everywhere in evidence. There are a few native trees, such as the hau, a *Hibiscus* often having incredibly twisted, snaky branches, sometimes utilized as a canopy for open air lanais. The screw palm, *Pandanus*, often grows along the shore. The wonderful forests of tree ferns, the tree Lobelias and tree composites are to be seen only higher up, mainly above the thousand foot level.

Where there is irrigation and cultivation, as around Honolulu, a multitude of beautiful and stately foreign plants flourish; the royal palm, *Poinciana*, monkey-pod, and golden shower (*Cassia*), are everywhere. Also fine banyans, each a grove in itself, and many graceful species of palms. Hedges of crotons and hibiscus are gay throughout the year.

On the lower levels and up the mountain slopes some 600 or 800 feet are great cane fields, which produced about 600,000 tons of sugar in 1920, earning huge dividends for the sugar companies. Where water for irrigation is not available, pineapples replace the cane. In the low valleys where there are natural streams, rice and taro are cultivated, both growing in water. The taro root, roasted, pounded and fermented, furnishes poi, a smooth, paste-like, starchy food, the chief bread stuff in the old days.

All of these crops are dependant upon water from the mountains mainly brought through long ditches which wind along the mountain spurs high on the valley sides. They derive their water from tunnels driven into the mountains to tap the porous strata under the rain forest above.

Though the lower zone is now more or less arid, there is evidence that this is largely a recent condition. In many places there are deposits containing land shells in great profusion, partly of extinct species, and often near sea level. These animals require moisture and forest conditions. During the Pleistocene period the islands must have been verdant nearly to the water's edge. The dessication has no doubt been accelerated by the destruction of forests, but it was evidently in progress before the coming of man.

Every visitor feels the charm of this "loveliest fleet of islands that lies moored in any sea" as Mark Twain has said. The glamour of the Pacific possesses one. Years drop away, and with a

fresh mind one looks upon a new and beautiful world. To the naturalist Hawaii has a further interest. It is the most isolated island group in the world. Over 2000 miles from America and Samoa, over 3000 from Japan, the fauna and flora of these islands have developed in their own way, little affected by the waves of life evolved on the continents and successively sweeping their predecessors out of existence. Birds, bats, insects and seeds which could be blown or float great distances could from time to time reach Hawaii. Creatures less capable of crossing the sea are either absent (mammals, amphibians) or are represented by ancient groups which here linger on beyond their time. The tree shells (*Achatinella*) belong to such a group, which long ago had its day on the continents and was then replaced by more highly organized snails.

In Hawaii the tree shells are known to every schoolboy. They collect them as we used to collect birds' eggs or stamps. The native Hawaiians formerly strung them into wreaths. They call them *pupukaneoe*, singing shells, claiming that they make a wild, entracing music in the forests. Achatinellas are glossy, jewel-like shells of many colors, green, brown, rose or gray, often banded, or pure white. Every ridge has its special species or patterns. When we were going for tree shells a start would be made the day before, camping at the limit of motor travel. Early next morning found us on the trail, headed for the ridge. As in the desert mountains of Arizona, the best shells are always on the highest ridges and peaks. Perhaps we will find them hanging on the bushes and trees by scores; it is like picking blackberries; but usually they are scarce and hard to see. On leaves, in crevices of the bark and knot-holes they stick, often ten or twenty feet high, indeed to the tree-tops. It is a climbing proposition. About the time we begin to find them it rains. This is not the "liquid sunshine" they talk about in Honolulu. It is a pour. After that you do not shy at puddles or wet foliage, knowing that the raiment can retain only so much water.

Where there is no trail, progress is usually difficult in the mountain forest. There are places where the ieie (a climbing *Pandanus*) is so thick that it is easier to scramble over it, ten feet from the ground, than to crawl through in the mud. Dense fern patches are even worse to negotiate. But if you really want to see the native birds, shells and insects, it is worth the trouble.

The native Hawaiians, sometimes called kanakas, from the Hawaiian word for man, are very dark-skinned people, finely built, with good features not unlike the Caucasian except that the lips are rather thick. They form now about a sixth of the population, and their blood is a good deal mixed with Portugese and Chinese. Practically all speak English, and they are well represented in the Territorial Legislature.

Hawaii was discovered and settled by the Polynesians about the year 1000 to 1100, according to tradition and native genealogies. The adventurous colonists were probably from Samoa. Did pressure of population drive them forth to discover new islands? Or was a canoe blown out of its course in some inter-island voyage? We will never know. But their landfall on the only islands in the vast north Pacific seems little short of miraculous. For some centuries after the settlement voyages were made back and forth between the old home and the new. Without the compass, in frail outrigger canoes, we cannot but admire the seamanship of a people willing to undertake that 2300 mile voyage.

With them the colonists brought the dog, pig, and fowl; also taro, cane, the banana, and perhaps the coconut. They were not cannibals, though sometimes captives of war were sacrificed to the Gods. Kamahameha I, of whom a fine statue stands before the Judiciary Building in Honolulu, was the first king controlling the entire group. In 1795, he defeated the Oahuans, driving their army up Nuuanu Valley and over the Pali, a 700 foot drop.

Hawaiians are still excellent boatmen, but while they work on cattle ranches and the like, they do not care for field and mill labor. In the industrial development of the islands, Japanese labor is almost exclusively used.

For the sessions relating to volcanos the Scientific Conference adjourned to the island of Hawaii. Here on the summit of Kilauea vulcanology was discussed by the masters of America and Japan, Jaggar, Omori, and others, illustrated by an active crater. Professor Jaggar, Director of the Volcano Observatory, has had Kilauea under daily observation for over ten years. The work begins a new era in the study of volcanos. To see Halemaumau, "the house of eternal fire", at night is one of the unforgettable sights of a lifetime. Black crags jut out of the fiery lake. Lava fountains give rise to rivers which stream to vortices where the

cakes of crusted lava tilt up and disappear, with din of lava surf breaking on the crags. At half hour periods all activity is intensified.

Where there have been no recent lava flows, the upper slopes of the volcano are richly clothed with forest. The trunks are covered with wet moss, giving roothold to ferns and flowering plants. The curious birdnest fern lodges in the branches. Further up there is fine tree fern jungle, followed by scarlet flowered lehua forest and in places great koa[2] trees.

Along the margin of the outer crater of Kilauea we noted one of the few northern hemisphere plants recognizable in the bewildering botany of Hawaii. It is the Ohelo, a huckleberry, much larger than ours, red, and fruiting in wonderful profusion. It was tabu in the old days, being sacred to Pele, the volcano goddess. It is very palatable, and makes a pie to be remembered with affection.

Among the greatest attractions of Hawaii is the hospitality of her delightful people. Perhaps it has limits, but we could find none. And it may be suspected that the resolve of each one of us to revisit Hawaii was really as much to enjoy again the friends we have made as to work on the scientific problems of the islands.

A TRIP TO THE SANTA MARTA REGION OF COLOMBIA.

By James A. G. Rehn.

If one looks at a relief map of the Republic of Colombia there will be seen in the western and west-central portion, the principal mountains of the country running in three roughly parallel northeast and south-west series. They will notice that the series or ranges come together in the south in what the geographers call "The Pasco Knot;" also that the valleys between the three ranges are occupied by the Magdalena River and its main affluent, the Cauca River. The three large divisions of the Colombian Andes are called the "Cordillera Occidental," "Cordillera Central," and the "Cordillera Oriental."

To the north the first two of these cordilleras die out before they reach the region of the Caribbean Sea, but the eastern or "Orien-

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[2] A species of *Acacia*.

tal," it will be noticed, extends off to the northeast, and apparently disappears in a peninsula extending into the Caribbean, the Goajira Peninsula, named after its but slightly civilized and war-like native inhabitants. Just to the east of the mouth of the great Magdalena river will be seen on the map a high group of mountains, apparently not connected with the Cordillera Oriental, near which they are placed, and coming down very sharply to the sea. These are the Sierra Nevada de Santa Marta, reaching an elevation of over seventeen thousand feet and the highest slopes of which are perpetually snow covered, like the higher Andes. Separated from the eastern Andes, the Sierra Nevada, as the name is generally shortened, is an island mountain mass, with a different geological history and some marked differences in its animal life from the chains of the Andes.

The animal life of this region has been investigated by a number of workers, usually interested in some special field of study, but outside of the vertebrate forms of life no more than a preliminary survey has been made. The work of a resident American zoologist, Mr. M. A. Carriker, Jr., and his encouragement and assistance to visiting student friends, have been very largely responsible for bringing to light many of the interesting things which have been discovered in the Santa Marta region.

Late in June, 1920, the steamer "Santa Marta" of the United Fruit Company left New York bound for Santa Marta, and among its passengers were Mr. James A. G. Rehn, Assistant Curator of the Academy, Mr. Morgan Hebard, Research Associate, and Mr. Frank R. Mason, a member of this institution. Their purpose in going to Colombia was to study and secure collections of Orthoptera, Coleoptera, and other insects from representative localities in and near the Sierra Nevada de Santa Marta. Calls at Kingston, Jamaica, Cristobal, Canal Zone, and Cartagena and Puerto Colombia, Colombia, ranging from one to three days, permitted some work to be done at each of these points.

The opportunities to work at Cartagena and Puerto Colombia were particularly valuable to us, as thereby important comparative material was secured and studies made, both of these localities being in the arid Caribbean Faunal Area. Here cacti, aloes, thorn-bearing and mimosa-like bushes and trees, and other plants, lovers of dry soils, largely made up a dense scrub, which was still in part leafless on account of the delayed onset of the rainy season.

Cartagena itself is quaint and Old World like, its churches and old walls, which caused Philip II so much concern and expense, show that the city dates back to 1553, while its streets suggest those of Cadiz, withal surprisingly clean and neat. Puerto Colombia is a small community clustered about the shore end of the iron pier of the Barranquilla railroad, a town whose existence is solely due to the dangerous bar at the mouth of the Magdalena River which prevents sea-going vessels reaching Barranquilla, the main port of the Republic. Thus, the imports and exports of a large part of the interior are left to the mercy of an antiquated, English controlled, narrow-gauge railroad, twenty odd miles in length. Puerto Colombia is anathema to most passengers bound for Santa Marta, as it may take as much as five days' time to unload and load cargo.

From the sea the Sierra Nevada de Santa Marta appeared first as a cloud-like mass hanging in the sky, and of such apparent height that it seemed incredible the mountains were before us. As the outlines sharpened and ridge beyond ridge were distinctly evident, the full magnitude of this mountain group forced itself upon one. We were not fortunate enough to be favored with a view of the snow summits from the sea, but our entrance into the beautiful harbor of Santa Marta will long be remembered.

The highest peaks of the Sierra Nevada de Santa Marta are virtually inaccessible from the north, and the upper slopes are best reached by circling the mountains and ascending from the Rio Cesar valley on the south. To the north of the high snow mountains is an outlying range of the system, which reaches an elevation of approximately 9000 feet, separated from the major portion of the mountains by gorge-like valleys with percipitous sides. This range is known as the San Lorenzo Mountains, after the highest of its peaks.

In the limited time at our disposal an effort to reach the higher snow mountains was virtually impossible, as well as undesirable from the standpoint of the work to be done. Our plan, as perfected after reaching Santa Marta, was to examine conditions about Santa Marta, in an arid environment much like that at Cartagena and Puerto Colombia; at a locality in the mountain forest; on the summit of the San Lorenzo range and in the heavy Magdalena type lowland forest to the west of the mountains. Thus we would be able to study and work typical localities of the Caribbean fauna and the Cauca-Magdalena fauna of the Tropical Zone, the Sub-

tropical Mountain Forest Zone and the Temperate Zone, as well as the peculiar semi-paramo conditions of the summit of San Lorenzo.

In the arid coast belt we worked at Bolivar, near Santa Marta, where we were the guests of Mr. Orlando L. Flye, the genial and hospitable Manager or "Gerente" of the Santa Marta Coffee Company. Here, at Hacienda Cincinnati and on San Lorenzo, we were assisted in every way possible by Mr. and Mrs. Flye, and other members of their family, as well as by Mr. Robert Sargent, the Superintendent of the Coffee Company at Hacienda Cincinnati. Their cordial and generous assistance remains one of the pleasantest memories of our Colombian work.

The vicinity of Bolivar differed from where we had worked at Puerto Colombia, as there was some land under irrigation, which brought in a greater diversification of insect life, although the delayed rains, a most important matter in the arid coast lands, had greatly retarded plant and insect development.

As a locality representative of the forest of the mountain slopes we studied the vicinity of Hacienda Cincinnati, a coffee plantation of the Santa Marta Coffee Company, situated on the western slope of the San Lorenzo range at an elevation of 4500 feet, and with large areas of uncut forest in the vicinity. On the way up the mule trail we passed from the coast region into one with stream course forest, and then into country originally, and yet in large part, solid forest. Here some weeks were spent and excursions made up to 6000 feet elevation, down to Minca at 2500 feet, and nearby forest tracts were regularly examined.

This mountain forest was very lofty, the low growth dense and tangled, the trees forming overhead a canopy which cut out much of the sunlight. Trees of the genus *Cecropia*, striking tropical American types, there called "guarumo" by the natives, were very important collecting places. Their large dead leaves, which hang or lodge suspended a long time, shed water admirably, and serve in the day time as sleeping or hiding places for cockroaches, crickets and katy-dids, occasionally sheltering a snake. A leptognathoid snake, known locally as a "mapaná," came vigorously to life out of a net full of guarumo leaves which was being examined.

In the mountain forest epiphytes or tree living plants were numerous, lianes and creeping plants abundant. Daily the cloud fog banks would sift into the forest about noon, and generally one or

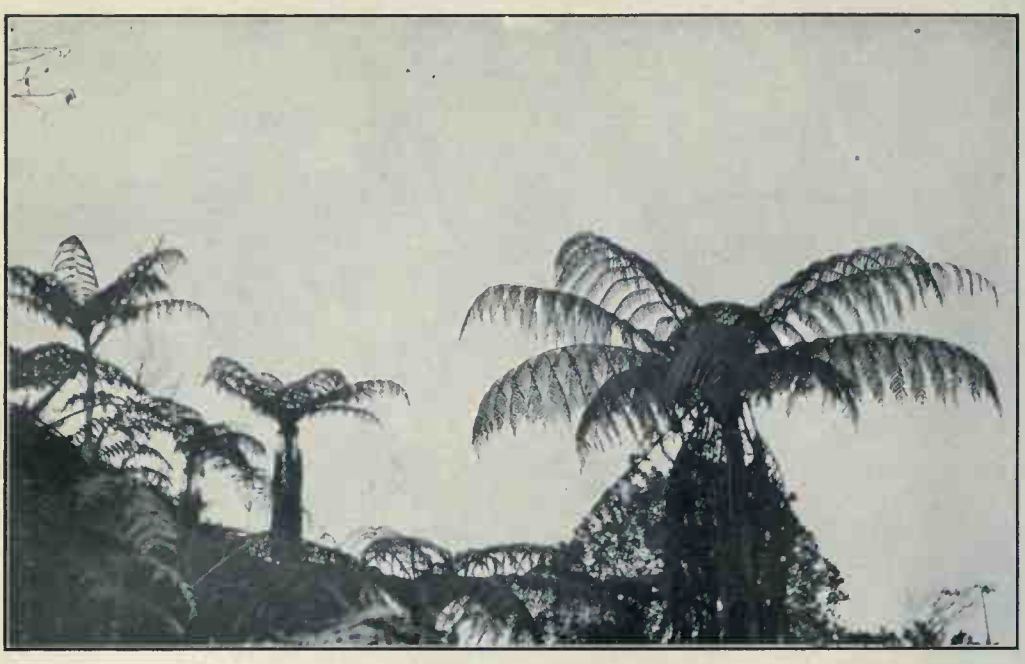
more showers would fall in the afternoon. Moisture was everywhere in evidence, but from outlooks the coast land could be seen in the sunlight but twenty miles away,—rainless and parched. In the mountain forest and the coffee groves the bird life was most interesting; guans, turkey-like birds of the tropical American family Cracidae, called "pavos" or peacocks by the Colombians, several species of toucans, a relative of the ivory-billed woodpecker, parakects, a number of species of humming-birds, weird woodhewers, wonderful *Euphonia*, *Calliste* and *Saltator* tanagers, black and white cotingas, a most home-like wren, and many other interesting types. A singularly beautiful voice of the forest was that of a very small frog, which in numbers called and answered in a most wonderful tinkling bell-like note, an invisible choir of chimes in the solemn mysteriousness of the forest twilight.

Every night at Hacienda Cincinnati several powerful gasolene pressure lights were burned to attract insects. Occasionally we carried our whole paraphernalia into the forest and erected our "moth tent" to give a white attracting surface. Much was also done at night with hand flash lamps, and many species secured in this fashion were not taken otherwise. The stretches of coffee trees themselves and open areas of heavy grass and patches of sugar cane all added their quotas to the collections made. Coffee is grown shaded by regularly planted guamo trees, which species is a relative of the mimosas and bears a huge pod, containing large beans which are occasionally eaten by the natives.

From Hacienda Cincinnati Mr. Flye has had a trail cut upward through the forest to near the summit of San Lorenzo, and over this trail, under the guidance of Mr. Robert Sargent, the genial Superintendent at Hacienda Cincinnati, we went for a three days' stay on the top of the San Lorenzo range. The forest remained much the same until an elevation of about 6000 feet was reached, when a gradual change became evident. The forest from this point became lower and more heavily tangled, large bromeliads became more evident, and, as we continued to ascend, the tree types changed considerably. Here the vegetation was much wetter than below, in fact water-soaked, with entangling vine bamboos; and giant tree ferns projected above the other members of the forest. Gnarled and twisted, but from twenty to thirty feet high and laden with bromeliads and mosses, these cloud-land forest trees had an unreal and spectral appearance. Over-topping all, the dominant feature

UPPER—Looking toward Santa Marta from the Cincinnati Trail down the valley of the Minca River.

LOWER—Vicinity of Hacienda Coffee Plantation. Elevation, 4500 feet. Coffee at right and in foreground growing in the shade of Guamo trees.



UPPER—Tree ferns in the subtropical mountain forests, at 7000 feet elevation.
LOWER—Looking from the summit of San Lorenzo Mountains, elevation 8000 feet, southeast over largely unmapped country to the snow covered peaks of the Sierra Nevada de Santa Marta, the summit of which is variously given as 15452 to 19000 feet above sealevel. Taken about seven A. M., before the gathering clouds obscured the peaks.

of the upper forest, above which they stood like sentinels, were the wax palms—one of the handsomest of its group and one peculiar to the mountains of this portion of tropical America.

This region was a most interesting one to study, with much in it not encountered above or below, and a difficult type of country to examine on account of the tangled forest and its generally saturated condition, aside from the steepness of the slopes. The bromeliads alone yielded much of interest in the way of insects which, either habitually or occasionally, seek shelter between their leaves. Remarkable frogs, and even a species of salamander, live in the wet pockets at the leaf bases, specimens of these, as well as the eggs of the frog, having been secured by our party.

At an elevation of seventy-nine hundred feet the forest ceases and above this we have a virtually treeless bald, except for protected ravines, up which the timber creeps. Here we have a region covered waist to shoulder high with a dense tangle of bracken, thorny berry vines and low perennials, with many beautiful annuals, which suggested more temperate climes than Colombia. The dominant feature of the vegetation, however, was the great abundance of large ground bromeliads, to which we applied ourselves with a machete and enthusiasm. Previous information was to the effect that certain very desirable species of cockroaches (Blattidae) lived in these plants, and we secured not only greatly desired material of these, but also most valuable data on their immature stages, abundance of notes upon other insects living in these strange homes, and also upon the frogs with similar proclivities. Many other insects were taken and our gasolene lights, which had been most carefully transported to this out-of-the-way place, yielded a remarkable catch of moths on one of the nights spent there.

A few rods from our camp the mountain range broke off abruptly to the south, dropping down thousands of feet, in sheer cliffs, to the great valleys which separate the San Lorenzo range from the ridges which roll up to the grand culmination of the Sierra Nevada itself. Many times we looked for the snow peaks, while we were on San Lorenzo, but the cloud masses of the rainy season were jealous guardians and only quite early in the morning could one get a view of their superb grandeur. Then the indescribable magnificence of the trinity of snow-covered pyramids, with the light play of the rising sun upon them, would be revealed. Thirty miles away this wonderful group stood out serene and glorious, above a

chaos of lower ranges and ridges, each in itself a great mountain mass. Peering over the edge of San Lorenzo into nearly solid cloud banks below, we would see through a rift in the mist here a group of wax palms, another there, then the up-rush of the mist would swallow us and the whole mountain top. The cloud eclipse would last minutes or hours; and cold and wet, one would occasionally get a glimpse through a rift in the fog, far below us and off to the north, of the yellow glare of the hot and dry country about Santa Marta. When the clouds would leave the summit we could see, off to the westward, patches of the great lowland forest, tongues of which reach over from the middle Magdalena region, the last of the types of country we had planned to examine.

To reach this lowland forest we returned to Santa Marta and travelled over the Santa Marta Railway to Aracataca, fifty-five miles from Santa Marta, somewhat to the southwest of the Sierra Nevada itself and virtually due south of San Lorenzo, which from there dominated the view to the north. When conditions were favorable the snows of the Sierra Nevada were visible, and one day the setting sun turned these summits, over sixteen thousand feet above us, into cones of burnished silver.

Aracataca is a typical Colombian village, and here we were favored by being guests of the United Fruit Company, which controls the Santa Marta Railway and, at a number of points of which Aracataca is one, has extensive banana plantations. Much of the country about Aracataca itself has been cleared and is in bananas or used as pasture land, many of the wine palms or "palma de vino" of the original forest still dominating the landscape. The heavy forest, however, was but a few miles away, and for two weeks we worked steadily in this environment, the great lowland forest of ceiba bongo, ceiba blanca, macundo, palma de vino, palo sancta, platanillo, or wild banana, and numerous other trees. The great macundos and ceibas tower a hundred feet or more without a branch, their trunks like great columns of some old temple, their heads short, broad and relatively flat. The undergrowth is very dense and almost impenetrable in places, while a perpetual twilight exists in much of this vegetable paradise.

Great macaws screamed overhead in this forest, the howling monkeys roared in the distance, and the leaf-cutting ants were everywhere busily engaged in cutting leaves and transporting them underground to their chambers. Ants which stung and bit, ticks, mos-

quitoes, and other insect annoyances, were present in great variety, while the humidity was always high. In the life of the field naturalist, the abundance and persistence of insects which prey, and humidity which enervates, are serious matters.

The wealth of life, both animal and plant, in this great lowland forest appears inexhaustable, and steadily continued work accumulates wonderful collections; but constant application, with painstaking examination of first one, then another type of habitat, finally shows results in a marked reduction of previously unseen forms. This forest, however, was the richest piece of country, from the insect standpoint, examined by the expedition.

In the vicinity of Aracataca other pieces of forest, relatively dry in character, heavily matted jungle scrub and meadow land of rank grass were also studied, and yielded in their turn important collections. Iguana lizards scuttled about the wine palms in the compound of the United Fruit Company; and bats, which roosted in hundreds in the attic over our room, tried collecting the insects attracted to our gasolene lights on the veranda. The bats were discouraged by our collecting some of them, and our lights continued to be centers of insect attraction. From Aracataca we returned to Bolivar, packed our collections, and sailed for home in late August.

As a result of the expedition the Academy was enriched by a collection of seven thousand seven hundred specimens of insects, of which four thousand four hundred were representatives of the order Orthoptera, the chief object of the field work of Messrs. Rehn and Hebard, as well as a moderate-sized collection of reptiles and amphibians, and a few mollusks. The greatest result of the work, however, was the accumulation of quantities of original observations made in the field, in numerous cases on species regarding which no knowledge of their habitats and occurrence exists in scientific literature. This information can be secured only by trained observers, and collections made without such correlated observations fall, to a very considerable degree, short of the full usefulness which could be theirs. These notes will be utilized as the detailed study work on the collection progresses.

The Academy is under lasting obligations to Mr. Orlando L. Flye and Mr. M. A. Carriker, Jr., for their untiring kindness and courtesy and invaluable assistance, and also to their respective families for their cordial hospitality to its representatives. The United Fruit Company, through Mr. R. K. Thomas, Assistant

Manager at Santa Marta, and Señor Jesus Bermudez, Superintendent at Aracataca, assisted our party in every possible way, and by its generosity enabled us to carry on work in comfort, which under other conditions would have been much more difficult and far less satisfactory. His Excellency, Señor Don C. A. Urueta, the Minister of the Republic of Colombia at Washington, most kindly assisted in every way possible, and by his intercession secured free entry into Colombia of collecting materials used by our party.

ADMINISTRATION OF THE MUSEUM.

BOARD OF CURATORS.

WITMER STONE, *Executive Curator.*
HENRY A. PILSBRY, *Secretary.*
SPENCER TROTTER, HENRY TUCKER.

SCIENTIFIC STAFF.

Vertebrate Zoology.
WITMER STONE, Sc. D., *Special Curator.*
WHARTON HUBER, *Assistant Curator, Birds and Mammals.*
HENRY W. FOWLER, *Assistant Curator, Fishes and Reptiles.*

Mollusca and other Marine Invertebrates.
HENRY A. PILSBRY, Sc. D. *Special Curator.*
EDWARD G. VANATTA, *Assistant Curator.*

Insects.
HENRY SKINNER, M. D., *Special Curator.*
JAMES A. G. REHN, *Assistant Curator.*
E. T. CRESSON, JR. *Assistant Curator.*
MORGAN HEBARD, *Research Associate.*

Plants.
STEWARDSON BROWN,* *Assistant Curator (in charge).*
BAYARD LONG, *Research Associate.*

Minerals and Rocks.
FRANK J. KEELEY, *Curator of the Wiltiam S. Vaux Collection.*
SAMUEL G. GORDON, *Assistant Curator.*

Anthropology.
MISS H. NEWELL WARDLE, *Assistant Curator (in charge).*

Taxidermist.
DAVID MCCADDEN.

Artist.
HELEN WINCHESTER.

*Deceased March 14, 1921.

Report of the Curators.

The exhibition halls of the Museum have been open free to the public throughout the year from 9 A. M. to 5 P. M. on week days, and from 1 to 5 P. M. on Sundays, and large numbers of visitors have availed themselves of the privilege of viewing the exhibits. The increase in the number of schools and classes accompanied by teachers, both from Philadelphia and nearby towns, has been very noticeable.

Additions have been made to many of the exhibits. Several valuable mammals presented by the Zoological Society of Philadelphia have been mounted, and several game heads and mounted fishes received from Miss Anne Thomson have been hung in the halls.

In the entrance hall the plan has been adopted of arranging on temporary exhibition collections or groups which will ultimately be placed in their respective departments. A group of muskrats showing a winter "lodge" or "muskrat-house" from the Delaware River marshes near Salem, N. J., procured for the Museum by Mr. Benjamin A. Carpenter; on it are several of the rats secured by Dr. Henry R. Wharton and the smaller rice rats which make their nests in the walls of the muskrat house. This is one of a series of groups of the local mammals of Pennsylvania and New Jersey which it is proposed to install. As a special exhibit two cases containing specimens of the more common mammals of the vicinity of Philadelphia have been arranged near by.

The collection of crabs and mollusks illustrating the life of the New Jersey coast marshes, presented recently by Dr. Witmer Stone, has been arranged in special cases in the entrance hall. Also a collection illustrating the rocks of the vicinity of Philadelphia and their stratigraphic relationship; and a collection illustrating the moulting of birds and the varied structure of bird plumage. These collections have attracted much attention, especially from school children.

During the spring months an exhibition of birds from the study

series was arranged, containing at first only the winter species, but with the spring migrants added at the dates on which they appear about Philadelphia, so that the collection contained the species that one would find in the vicinity of the city at any given time.

A similar series of pressed wild flowers from the herbarium was also on exhibition during the spring.

Through the coöperation of the Ludwick Institute provision has been made in the coming year for a department of Public Instruction, the head of which shall be a member of the Curators' staff. Besides taking over the management of the lecture courses, which are already conducted by the Ludwick Institute, he will prepare educational exhibits, and have a general supervision of the public exhibition collections. Important results are looked for from this department, which will bring the Museum into closer touch with the schools and the general public, and relieve members of the scientific staff from duties that did not properly pertain to their work.

While the museum staff has been constantly engaged in the study of material in the various departments, much valuable field work has also been accomplished. Mr. J. A. G. Rehn was sent to Santa Marta, Colombia, coöperating with Mr. Morgan Hebard, Research Associate in the Department of Entomology, and Mr. Frank Mason, a member, who had organized a trip to this region. Large numbers of insects were obtained, the collection of Orthoptera being of chief interest, although series of Lepidoptera and Coleoptera of almost equal extent were secured, as well as a valuable series of reptiles.

Dr. Henry A. Pilsbry attended the Pan-Pacific Conference at Honolulu as the Academy's delegate, and was able to obtain a valuable collection of Hawaiian Mollusca supplementing that obtained by him in 1913.

Dr. Henry Skinner made a trip to the vicinity of Glenwood Springs, Colorado, from there to the Sierra La Sal, in Utah, stopping at several other points on his return, and has presented the Academy with the valuable series of insects secured.

Local collections of interesting plants and birds were made by Dr. Stone at Cape May, N. J.; of plants from various nearby localities by Mr. Bayard Long; and of fishes and reptiles by Mr. H. W. Fowler; while Mr. Samuel G. Gordon has made important geological studies along the southern tier of counties in Pennsylvania

and obtained a large number of valuable additions to the mineralogical collections.

Details of work in the several departments and accessions for the year follow:

MAMMALS.

Many specimens have been received from the Zoological Society of Philadelphia which have been variously prepared as skins, skeletons, or mounts. An important collection of game heads was received from Miss Anne Thomson, formerly the property of her brother the late Frank Thomson. Certain of the Californian jumping mice in the collection have been studied during the year by Dr. Joseph Grinnell; and the entire series of western chipmunks has been loaned to the U. S. Biological Survey for study in connection with Mr. Howell's monograph of this group.

BIRDS.

A fine series of birds and eggs collected at St. Marks, Florida, by Mr. C. J. Pennock was purchased during the year, and many specimens presented by the Zoological Society of Philadelphia were prepared as skins or osteological specimens. The valuable collection of East African birds obtained by Mr. Geo. L. Harrison, Jr., in 1903, and which had been deposited in the Academy, has been generously presented by him. A valuable series of eggs and nests of Pennsylvania birds was received in exchange from Mr. R. C. Harlow.

The entire series of bird skins was carefully examined during the year and found to be in excellent condition. The collection of eggs was entirely rearranged and several families of birds critically studied. A unique collection of local birds, beautifully mounted on hard wood bodies in glass covered boxes was presented by Mr. Edward Mattern. This it is proposed to complete and use for the exhibit of bird life which has been a feature of the Museum in the past two seasons, during the period of spring migration.

The Curator has received from Princeton University the remainder of the birds obtained on the Patagonian Expedition and has been engaged in completing the report on this collection for the series being published by that University.

Messrs. W. L. Sclater, of London; W. B. Alexander of Western Australia; Mr. A. Haagner of South Africa have visited the department during the year; and many American ornithologists have made use of the collections.

REPTILES AND FISHES.

Mr. H. W. Fowler in charge of these collections has cared for the numerous accessions received during the year, and has determined and labelled most of them.

An extensive report on the fishes of the U. S. (Wilkes) Exploring Expedition to be published by the U. S. National Museum was completed during the year, and a paper on local fishes obtained during 1919 was published in the PROCEEDINGS of the Academy.

Local collecting trips were taken during the year to various points in Pennsylvania, Delaware and Maryland.

MOLLUSCA.

The collection of Mollusca has received numerous important accessions largely from material sent for study and identification to the Curator, Dr. H. A. Pilsbry, from which the Academy has been given duplicate series. Among the most important collections are those from South Africa, from H. C. Burnup; from the Belgian Congo, from the American Museum of Natural History; and many lots from various parts of the United States, especially the J. H. Ferriss collection from northern Arizona, the J. B. Clark collection from Florida, Delaware, etc. The preparation of the Pupillidae for the "Manual of Conchology" has been continued during the year by Dr. Pilsbry, the subfamily *Vertigininae* being completed; various papers on the shells of Central America, Hawaii, and Haiti, have been published by him, and by Mr. E. G. Vanatta.

INSECTS.

Dr. Henry Skinner, head of the Department of Insects, reports that nearly 19,000 specimens have been added to the collections during the year. Practically all of his time has been taken up with the care and determination of the accessions of Lepidoptera, and in preparing reports on certain of the collections, besides important field work accomplished in the Sierra La Sal, Utah.

In the Hymenoptera, Mr. E. T. Cresson, Jr., has completed the determination and marking of the types. In the Diptera he has

completed a revision of the Sciomyzidae and rearranged certain other families, while he also made a study of the Loew types in the Museum of Comparative Zoölogy. One of the most important accessions of the year was the Harbeck collection of Diptera, purchased by the Academy, comprising 9,300 specimens and 1,579 named species making the collection of North American flies very complete. Mr. Rehn and Mr. Hebard have devoted all of their time, except the summer months when they were in South America, to the study and arrangement of the Orthoptera. Mr. Hebard has added to his collection, on deposit at the Academy, the Hancock collection of Tettigidae, the most representative in the world.

Mr. Rehn has completed a study of the Dermaptera of the American Museum Congo Expedition; and a study of the Blattidae in the Transvaal Museum collection is nearly completed. From both, the Academy receives a representative series of duplicates.

Mr. Hebard in the course of his studies has determined South American collections of Blattidae, etc., from the Paris Museum, and has continued his monograph of the North American Melanopli.

HERBARIUM.

The rearrangement of the Herbarium in the new room has progressed, as far as cases are available, under the direction of Mr. Stewardson Brown, in charge of the Department, the remainder of the general series being accommodated in a room at the S. W. corner of the building, where duplicates and portions of the Porter collection are stored.

The greater part of Mr. Brown's time has been occupied in determining the Arizona Collection made last year by Dr. Witmer Stone, and in preparing for mounting a valuable collection of British Colombian and Alaskan plants presented by Mr. Adolph Müller. Portions of the Canadian material received by purchase early in the year have also been mounted, as well as other large accessions. Mr. Bayard Long has continued in charge of the local collections and has studied critically a number of groups, besides securing many additional specimens on collecting trips in local territory. There has now accumulated a large amount of such material which is awaiting mounting before it can be placed in the regular series.

MINERALS.

During the past year the concentration of the mineral and rock collections in the new quarters was completed. The collection of the Second Geological Survey of Pennsylvania was brought up from the basement and placed on the first floor, where the specimens are readily accessible, while the rock collection was removed to the second floor. A room in the basement has been assigned for the storage of the First Geological Survey collection, the duplicates of the Second Survey, and the Woolman collection of New Jersey well records.

A small hand lap has been installed for grinding thin sections.

Among the more important accessions of the year were specimens of the Mt. Joy and Cumberland Falls meteorites, and a collection of American rocks, which were obtained from the U. S. National Museum by exchange; and a collection of stalactities and stalagmites from the Redington cave, Northampton County, Pennsylvania.

During the spring, Mr. Gordon spent three weeks studying the chromite deposits and albite pegmatites of southern Pennsylvania and Cecil County, Maryland. During the summer a collecting trip was taken through Virginia, the itinerary including the Amelia mica mines, Irish Creek tin mines, and the Midvale, Rockbridge County, durrenite locality. The rest of the summer was spent in visiting localities in Pennsylvania; and in studying the Ordovician diabases and basalts of Lebanon County.

ARCHAEOLOGY.

Miss H. Newell Wardle, in charge of this department, reports that the Archaeological and Ethnological collections, having now reached the limits of congestion, no further additions can be made to the general exhibit until new cases are procured. Two small cases in the adjoining room, having been placed at the service of the department, have been devoted to the temporary display of recent additions to the collection and special exhibits of specimens, hitherto stored. It is designed to change their contents periodically.

Progress has been made in the sorting, cataloging, and care of the Gottschall collection of North American Indian material.

Mr. Clarence B. Moore was again compelled to forgo his usual autumn expedition to the southern states. His spring expedition to the Florida west coast and keys resulted in the discovery of new types of aboriginal shell-implements.

REPORT OF THE CURATOR OF THE WILLIAM S. VAUX COLLECTIONS.

Mr. F. J. Keeley, Curator of the William S. Vaux collections, reports that the more important accessions during past year, include four specimens of meteorites obtained by exchange with the United States National Museum, and one purchased.

The following mineral specimens were presented: magnetite, French Creek Mines, Pa.; actinolite, Pleasant Grove, Penna.; colerainite, Brinton's Quarry, and Sylmar, Pa.; andradite, Cornwall, Pa.; pyrite and pyrrhotite, French Creek Mines, Pa.; microcline and albite, Amelia, Va. The first named was the gift of Frederick Oldach; the others from Samuel G. Gordon.

Forty-nine specimens of minerals were purchased, including an interesting series of corundums from Unionville, Pa.

As in previous years, specimens received have been labelled and placed in the collection by Mr. Samuel G. Gordon.

ADDITIONS TO THE MUSEUM.
1920.

MAMMALS.

MRS. ELIZABETH H. BENSON, in memory of Charles Hamilton Benson.—Skin of Grizzly Bear (*Ursus horribilis*), and six pairs of mounted horns.

MRS. M. C. BOOTH. Mole (*Scalopus aquaticus*) from Haverford, Pennsylvania.

HAMPTON L. CARSON. Mounted head of abnormal Prong-horn Antilope (*Antilocapra americana*) and skull of Mountain Goat (*Oreamnos montanus*).

MISS SARAH CROSSETT. Mounted Wild Cat (*Lynx ruffus*).

WHARTON HUBER. Skeleton of Mearns' Coyote (*Canis mearnsii*).

W. L. KAHLEN. Skin of Mountain Goat (*Oreamnos montanus*).

ZOOLOGICAL SOCIETY OF PHILADELPHIA. Specimens prepared as follows:—Skin and skull: male Black Buck (*Antilope cervicapra*), Purple-faced Monkey (*Pygothrix cephaloptera*). South African Ground Squirrel (*Xerus capensis*), Squirrel Monkey (*Saimari sciureus*), Tamandua Anteater (*Tamandua tetradactyla*). Skin and skeleton: male Chacma Baboon (*Papio porcarius*), and male Urial (*Ovis vignei*). Skeletons: female Leche Waterbuck (*Kobus lechi*), Llama (*Llama glauca*). Skulls: Black-striped Wallaby (*Macropus ruficollis*), Nail-tailed Kangaroo (*Onychogale unguifera australis*), Timber Wolf (*Canis occidentalis*), Bles-bok (*Damaliscus albfrons*) and Short-tailed Wallaby (*Macropus brachyurus*).

BIRDS.

CHARLES W. BECK. White Swan (*Cygnus olor*) picked up on the ice at Beach Haven, New Jersey.

MISS SARAH CROSSETT. Seven mounted Birds.

LAWRENCE FARRELL. Great Horned Owl (*Bubo virginianus*).

GEORGE L. HARRISON, JR. Collection of African Birds on deposit for some years past.

DR. WILLIAM E. HUGHES. Collection of Peruvian Bird-skins.

EDWIN S. MATTERN. Collection of mounted Birds from Pennsylvania, North Carolina, South Carolina, and Florida.

DR. MCKAY. Mounted Great Horned Owl (*Bubo virginianus*), and Screech Owl (*Otus asio*).

H. C. PIERSON. Skin of young Great Horned Owl from Chester County, Pennsylvania.

DR. R. W. SHUFELDT. Skeleton of Grebe (*Tachybaptus philippinensis*).

DR. HENRY SKINNER. Skin of Silver Pheasant (*Gennaeus nycthemerus*).

JOHN C. TRAUTWINE. Mounted Resplendant Trogon (*Pharomacrus mocino*), from Honduras.

DR. SPENCER TROTTER. Skull of Kittiwake Gull (*Rissa tridactyla*) from Nova Scotia.

ZOÖLOGICAL SOCIETY OF PHILADELPHIA. Hyacinthine Macaw (*Anodorhynchus hyacinthus*) twenty-six years and seven months in the Gardens. Skins of Swainson's Francolin (*Pterinstes swainsoni*), Pennant's Parrakeett (*Platycercus elegans*) and Ouzel Skin, and skeleton of Rhea (*Rhea americana*). Skeleton: male South African Ostrich (*Struthio australis*).

R. C. HARLOW, in exchange, series of eggs of Pennsylvania birds.

REPTILES AND AMPHIBIANS.

DR. HOUSEMAN. Nine jars of Snakes, found on logwood steamers at Philadelphia.

BAYARD LONG. Collection of Amphibians and Reptiles from Nova Scotia.

MUSEUM OF COMPARATIVE ZOÖLOGY, in exchange, *Rana grylio* and *Pseudotriton montanus*.

HERBERT J. PACK. Collection of Reptiles from Utah.

DR. R. W. SHUFELDT. Southern Tree-frog.

FISHES.

RICHARD M. ABBOTT. Harvest Fish (*Seserinus paru*) from Rhodes River, Maryland.

RICHARD M. ABBOTT and HENRY W. FOWLER. Two Fishes from Rhodes River, Maryland.

W. O. ABBOTT. Bottle of Fishes from Wood's Hole, Massashusetts.

ED. CORUMAN. Black Drum (*Pogonias cromis*) from New Jersey.

MORGAN HEBARD. Two jars of Fishes from Florida.

HOWARD R. HILL. Ten Fishes from Pensacola, Florida.

PROF. CHARLES LA WALL. Two Grunts (*Orthopristis chrysopterus*) from New Jersey.

H. L. MATHER and HENRY W. FOWLER. Jar of Fishes from Maryland.

MASAMITSU OSHIMA. Jar of types of Formosan Cyprinoids.

HERBERT J. PACK. Collection of Fishes from Utah.

H. L. THOMPSON, LEWIS DORSEY and HENRY W. FOWLER. Five bottles of Fishes from Lower Delaware.

UNITED STATES NATIONAL MUSEUM. Twenty-nine Macrurids.

DR. R. O. VAN DEUSEN. Harvest Fish (*Seserinus paru*) from Fortescue, New Jersey.

RECENT MOLLUSCA.

R. M. ABBOTT. One tray of young *Ampullaria* from Trinidad.

DR. W. L. ABBOTT. Seventeen trays of land and fresh water shells from Pennsylvania and the island of Hayti.

W. O. ABBOTT. Seventeen trays of aquatic shells from Massachusetts and New Jersey.

JACOB AEBLY. Four species of marine shells taken from a duck.

M. ALLEN. Four species of marine shells.

REGINALD ALLEN. *Conus vexillum* Mart.

AMERICAN MUSEUM OF NATURAL HISTORY. One hundred and eighty-eight trays of land shells from the Belgian Congo.

E. ASHBY. Forty-three trays of marine shells from Australia.

F. C. BAKER. Ten trays of fresh water shells from northern United States.

E. B. BARTRAM. Eight species of land and marine shells from Arizona and California.

DR. PAUL BARTSCH. *Blanfordia formosana* Pils. from Taichu Province, Formosa.

DR. J. BEQUAERT. Seven species of African land shells.

S. S. BERRY. Nine species of shells from western North America.

BERNICE PAUAHI BISHOP MUSEUM. Twenty trays of land shells from the Hawaiian Islands.

PROF. J. CHESTER BRADLEY. Three land shells from Georgia.

LOUIS H. BREGY. Forty trays of land and marine shells from Utah and Cuba.

ALBERT E. BROOKES. *Plaxiphora coelata* Rve. from Doubtless Bay, New Zealand.

W. A. BRYAN. Three hundred and fifty-six trays of Hawaiian marine shells.

MRS. H. H. BUCKMAN. Six species of land shells from Clyde, North Carolina.

H. C. BURNUP. One hundred and thirty trays of African shells.

FRED L. BUTTON. *Vertigo ovata* Say from Seattle, Washington.

GEO. H. CLAPP. Nine trays of land and fresh water shells.

W. F. CLAPP. *Planorbis parvus* Say from Lexington, Massachusetts.

JAMES B. CLARK. Two hundred and seven trays of shells from Eastern United States.

T. D. A. COCKERELL. Five trays of land shells from Colorado.

ALFRED M. COLLINS. Two marine shells from Africa.

M. CONNOLLY. *Nesopupa g. rhodesiana* Pils. from Rhodesia.

PROF. F. CONTRERAS. Eleven trays of Mexican fresh water shells.

W. J. CRESSON Jr. Three species of land shells from Pennsylvania.

PROF. PH. DAUTZENBERG. Two species of Chitons from France.

J. H. FERRISS. One hundred and eighty trays of West American land shells.

H. W. FOWLER. *Segmentina jenksii* Cpr. from Piermont, New York.

JULIA GARDNER. Six species of land shells from Jamaica.

CALVIN GOODRICH. Thirty-four trays of fresh water shells from central United States.

MORGAN HEBARD. Nine trays of American shells.

JOHN B. HENDERSON. Eleven trays of Cuban land shells.

JUNIUS HENDERSON. *Pupoides hordaceus* Gabb from St. Miguel County, Colorado.

A. A. HINKLEY. Eighty-nine trays of shells from Central America and Mexico.

A. HINKLEY and J. FERRISS. Four land shells from Arizona.

C. W. JOHNSON. Nine marine shells from Florida.

F. J. KEELEY. Eggs of *Ampullaria depressa* Say from Hawks Park, Florida.

BAYARD LONG. Seventy trays of shells from Nova Scotia and eastern United States.

BRUCE MARTIN. *Epiphragmophora t. cypreophila* Nc. from Fresno, California.

DAVID MCCADDEN. Two species of Naiades from Delaware.

REV. H. E. MEYER. Eight exotic shells.

CLARENCE B. MOORE. Eighty-one trays of land shells from Florida.

DR. J. P. MOORE. *Oreohelix strigosa* var. from Utah.

W. M. MUNRO. Sixteen trays of shells from Texas.

MRS. IDA S. OLDROYD. Seventy-eight trays of West American shells.

A. A. OLSSEN. Four land shells from Panama.

J. M. OSTERGAARD. Twelve trays of marine shells from Territory of Hawaii.

J. H. PAINE. *Ancylus* from California.

HERBERT J. PECK. Three fresh water shells from Utah.

H. A. PILSBRY. One hundred and thirty-two trays of shells from Hawaiian Islands.

PURCHASED. Two hundred and twenty-four trays of exotic shells.

CHARLES RAMSDEN. Thirteen trays of Cuban shells.

J. A. G. REHN and M. HEBARD. Thirty-six trays of land shells from North and South America.

JOSEPH ROSENFELT. One pearl from *Ostrea elongata* Sol.

M. SEAMAN. Nine species of marine shells from Liberia.

DR. HENRY SKINNER. *Oreohelix h. betheli* P. and C. from Glenwood Springs, Colorado.

BURNETT SMITH. Seventeen trays of fresh water shells from New York.

H. H. SMITH. *Polita carolinensis* Ckll. from near Stevenson, Alabama.

MAXWELL SMITH. Two species of shells from Arkansas and Arabia.

IRWIN SPALDING. *Achatinella elegans* Nc. from Hauula, Oahu.

E. T. STUART. Seven trays of marine shells.

D. THAANUM. Seventy-one trays of land and marine shells from Territory of Hawaii and Japan.

D. THAANUM and D. LANGFORD. Eight trays of Hawaiian marine shells.

L. A. THURSTON. *Viviparus georgianus* Lea, from West of Daytona, Florida.

UNIVERSITY OF MICHIGAN, in exchange. *Oreohelix i. baileyi* Bartsch from Snake River Canyon, Idaho.

E. G. VANATTA. *Ovula ovulum* L.

DR. BRYANT WALKER. Five trays of shells from Guatemala and Michigan.

M. L. WINSLOW. Ten trays of *Succinea* from North Dakota.

MRS. C. W. WOODWARD. *Megalatractus aruanus* L.

JAMES ZETEK. Eleven trays of land shells from Panama and the Canal Zone.

INSECTS.

W. L. ABBOTT. Fifteen Lepidoptera, two Coleoptera, Haiti.

ACADEMY COLOMBIAN EXPEDITION. Two thousand two hundred and thirty-five Ortoptera and three thousand two hundred and two other insects.

C. P. ALEXANDER. Twenty-two Craneflies, Japan.

E. B. BARTRAM. Nine insects from Arizona.

WILLIAM BEUTENMULLER. Thirty-seven *Cychrus*, North Carolina.

E. H. BLACKMORE. Four butterflies. Vancouver.

J. G. BONNIWELL. Two moths from Texas and two from New Mexico.

ANNETTE F. BRAUN. Twenty-four Microlepidoptera, United States.

P. P. CALVERT. Two *Aedes*. One Ascalaphid, Ecuador. Fifteen Lepidoptera, Costa Rica. Two slides of Mallophaga, Pennsylvania.

T. D. A. COCKERELL. *Furcaspis biformis*, Colorado.

W. P. COMSTOCK. Three butterflies, Utah and California.

W. J. COXEY. Two *Attacus aurantiaca* Ke Island. *Payilio toboroi*, New Guinea. Forty butterflies, Madagascar.

JOHN J. DAVIS. Eighteen *Lachnosterna*, United States.

W. T. DAVIS. Two *Okanagana magnifica*, New Mexico.

C. L. FOX. Seventeen *Argynnis*, California.

C. W. FROST. Dragonfly, Haverford, Penna. Beetle, Phila. Penna.

FRANK HAIMBACH. Two moths, Colorado and Mexico.

D. E. HARROWER. Thirteen specimens of *Thecla*.

HAWAIIAN SUGAR PLANTERS' ASSOCIATION. Two mole crickets (*Gryllotalpa*).

HEBARD-ACADEMY EXPEDITION, 1919. One hundred and fifty Coleoptera, sixteen Diptera, fifteen Odonata, one hundred Lepidoptera. Western U. S.

MORGAN HEBARD. Eighty Lepidoptera, Virginia. One hundred and eight Lepidoptera, Michigan. One hundred and one Lepidoptera, Georgia. Twenty-five Orthoptera, Arizona. Seven hundred and fifty Hymenoptera, United States. Twenty-four Hemiptera, California. Thirty Diptera, Western U. S. Two hundred and ninety-five Hemiptera, United States. Fifteen Neuroptera, United States. Four insects, Africa.

H. HORNIG. Forty Culicidae. Pennsylvania.

DR. HOUSEMAN. Eight bottles of insects, found on logwood steamers at Philadelphia.

W. E. HUGHES. Seven Cicada, South America.

J. C. HUGUENIN. Three butterflies, California.

C. W. JOHNSON. Sixteen Anthomyidae, United States.

PHILIP LAURENT. Ten Diptera, Florida. Four Lepidoptera, Pennsylvania.

R. A. LEUSSLER. Two *Euphydras bernadetta*, Nebraska. Nine Rhopalocera, Nebraska.

FRANK R. MASON. One hymenopteron, U. S.

PURCHASED. Five hundred and fifty-five Orthoptera, Madagascar. Forty-one moths, Arizona. Two hundred and twenty-six Hesperidae, Colombia.

PENNSYLVANIA DIVISION OF PLANT INDUSTRY. Seven Orthoptera from Pennsylvania and Arizona.

C. T. RAMSDEN. Five Hesperidae, Cuba.

L. P. ROCKWOOD. Twenty-six Orthoptera from the Northwestern United States.

WILLIAM SCHAUS. Seventy-two moths, Central America. One hundred and forty moths, Guatemala. Fifteen Rhopalcera, Mexico and Central America.

J. W. SCHELL. Japanese mantis (*Tenodera sinensis*).

HENRY SKINNER. One hundred and eighty-two Lepidoptera. One hundred and nineteen Orthoptera. Sixty Diptera. Thirty-four Coleoptera. Eleven Hymenoptera, Sierra La Sal, Utah.

STATE ENTOMOLOGIST OF NEW YORK. Two specimens of *Anisolabis maritima* from New York.

O. A. STEVENS. Eleven Insects, North Dakota.

WITMER STONE. Four *Colias*, New Jersey.

R. J. TILLYARD. Three Micropterygidae, Four Neuroptera, New Zealand.

U. S. NATIONAL MUSEUM. Three Cynipidae.

UNIVERSITY OF MICHIGAN MUSEUM. Two hundred and forty-one Orthoptera from Texas, Oklahoma, Michigan, and Illinois.

R. C. WILLIAMS, JR. Twenty one slides of *Lycaena* genitalia.

OTHER INVERTEBRATES.

C. M. BARBEAU. One tray of *Balanus* from British Columbia.

DR. S. S. BERRY. *Lepas fascicularis* from Oceanside, California.

W. A. BRYAN. One tray of *Terebratula* from the Hawaiian Islands.

CANADA GEOLOGICAL SURVEY. Twenty-five trays of barnacles from British Columbia.

R. CHAMBERLAIN. Four paratypes of *Neoscena salaeria*.

MORGAN HEBARD. Several invertebrates from Florida.

HEBARD-ACADEMY EXPEDITION, 1919. Three scorpions from Arizona and New Mexico.

DR. HOUSEMAN. Four jars of spiders and scorpions found in logwood steamers at Philadelphia.

PHILIP LAURENT. *Gordius* from Gunntown, Florida.

MRS. IDA S. OLDROYD. Eight trays of invertebrates from West America.

H. A. PILSBRY. Nine trays of Hawaiian invertebrates.

S. RAYMOND ROBERTS. *Balanus crenatus* Brug. from Vineyard Haven, Massachusetts.

STANFORD UNIVERSITY. *Chelonobia testudinaria* from Galapagos Islands.

WITMER STONE. One tray of *Lepas* from Cape May, New Jersey.

UNITED STATES FISH COMMISSION. Two New England barnacles.

UNITED STATES NATIONAL MUSEUM. Fourteen trays of barnacles from Western America.

MRS. JAMES F. WOOD. *Moira atropos* Kl. from Boca Grande, Florida.

JAMES ZETEK. *Megalasma subcarinatum* Pils. from Pacific Ocean cable.

FOSSIL INVERTEBRATES.

JAMES B. CLARK. Four trays of Pliocene shells from Florida.

W. M. MUNRO. *Exogyra arietina* Roem., from near Austin, Texas.

LLOYD B. SMITH. One *Naticopsis* from Texas.

MINERALS.

MORRELL BIERNBAUM. Chabazite and actinolite, Pennsylvania.

SAMUEL G. GORDON. Fifty-four Pennsylvania minerals, including a collection of stalactites and stalagmites from the Redington Cave.

HUGH ALEX. FORD. Thomsonite, Lenni, Penna.

F. LYNWOOD GARRISON. Chromite, Line Pit, Lancaster County.

JOHN FRANKENFIELD. Pyrrhotite, and Magnesite, Pennsylvania.

A. C. HAWKINS. Deweylite, Elam, Pennsylvania.

CALIFORNIA MINING CO. Wulfenite, Arizona.

LEHIGH UNIVERSITY, in exchange, Wavellite and axinite, Pennsylvania.

LEVI MENGEL. Natrolite, Birdsboro, Pennsylvania.

BENTLEY R. MORRISON. Apophyllite, French Creek mines, Chester County, Pennsylvania.

FREDERICK OLDACH. Magnetite, French Creek mines; and erythrite and arsenopyrite, Gickerville, Berks County, Pennsylvania.

HUGO ROTHSTEIN. Roscoelite, and carnotite, Vanadium, Colorado.

HENRY A. PILSBRY. Sulphur, Hawaii.

HARRY A. WARFORD. Prehnite, Lenni, Pennsylvania.

H. L. WILLIG. Amethyst, Lancaster County, Pennsylvania.

EDGAR T. WHERRY. Allanite, and chloropal, Berks County, Pennsylvania.

ROCKS.

SAMUEL G. GORDON. Collection of rocks from the chromite deposits and albite pegmatites of southern Pennsylvania and Cecil County, Maryland. Collection of diabases and basalts of Lebanon County, Pennsylvania.

HENRY A. PILSBRY. Basalt scoria, and olivine basalt, Hawaii.

U. S. NATIONAL MUSEUM, in exchange. Collection of American rocks. Mt. Joy, Adams County, Pennsylvania, meteoric iron. Cumberland Falls, Ky., meteoric stone.

PLANTS.

H. G. ALLEBACH. Several specimens from Berks County, Pennsylvania.

E. B. BARTRAM. Eighty-five Arizona plants.

G. W. BASSETT. Plants from Long Island, *Tipularia*.

WALTER BENNER. Collections from Eastern Pennsylvania.

REV. T. R. BRENDLE. Collection from Fortesque New Jersey, and the Perkiomen Valley, Pennsylvania.

O. H. BROWN. Several collections from Cape May County, New Jersey.

T. FRANKLIN COLLINS. Portion of type lot of *Polygonum Pennsylvanicum* var. *nesophilum* Fernald, Block Island, Rhode Island.

DR. C. D. FRETZ. *Oxalis corniculata*, Sellersville, Pennsylvania.

MRS. L. S. GALE. *Cornus florida*, Tuckerton, New Jersey.

GRAY HERBARIUM. Four sspecimens of *Cerastium* from Newfoundland and Labrador.

W. S. HAMMOND. Collection from Oregon formed by E. W. Hammond.

RALPH HOFFMAN. Several *Eragrostis* from Berkshire County, Massachusetts.

A. N. LEEDS. *Prunus cuneata*, Serpentine Barrens, Chester County, Pennsylvania.

B. LONG. Numerous Pennsylvania and New Jersey plants.

DR. H. B. MEREDITH. Sixty-five local plants, *Crepis biennis*, Dunville, Pennsylvania.

ALEXANDER MACELWEE. Five hundred plants from Pennsylvania, New Jersey and West Virginia.

J. C. NELSON. *Alopecurus geniculatus*, Oregon.

ADOLPH MÜLLER. Four-hundred plants from British Columbia and Yukon Territory.

NEW YORK BOTANICAL GARDEN. One-hundred and sixty-seven plants in exchange.

H. A. PILSBRY. *Lycopodium sp?*, Oahu.

H. W. PRETZ. Four hundred plants chiefly from Lehigh County, Pennsylvania.

J. K. Potter, *Juniperus communis* Seaside Park, New Jersey.

GEO. REDLES. Local specimens of *Lemna minor*, *Arctium lappa* and *Campanula americana*.

J. A. G. REHN and MORGAN HEBARD. Seven plants.

WITMER STONE. *Myrica carolinensis*, Cape May, New Jersey.

H. W. TRUDELL. *Crataegus* from Roan Mt., Tenn.

UNIVERSITY OF PENNSYLVANIA. *Lophiola* from Mississippi.

T. B. WALTER. *Penstemon hirsutus* and *Convolvulus arvensis*, Wissahickon, Philadelphia.

PURCHASED BY THE BOTANICAL SECTION (REDFIELD FUND).. Six hundred and fifty-five plants from Texas and the Southern Appalachians.

PURCHASED BY THE ACADEMY. Fifteen hundred plants from Canada.

ARCHAEOLOGY.

DR. W. L. ABBOTT. Sleeping and sitting-mats, Madagascar.

WM. E. HUGHES, M. D. Peruvan Indian belt.

CLARENCE B. MOORE. Shell-heap material, Florida.

DR. ELIZABETH SNYDER. Crania and basketry of Cliff Dwellers, Utah.

MISS ANNE THOMSON. Frank Thomson collection of old Indian bead-work, basketry, etc.

IN EXCHANGE. Pottery from the Cliff dwellings, Colorado and New Mexico.

Reports of Sections.

BIOLOGICAL AND MICROSCOPICAL SECTION.—The Biological and Microscopical Section held nine stated meetings during the year, with a slightly increased attendance and membership. The class in microscopic technique formed last year has now become a new association, called the Philadelphia Microscopical Society, and meets at the Wagner Free Institute of Science.

Twenty-three weekly excursions were made to various localities near the city, with an average attendance on each trip of twelve members and their friends.

Communications on various subjects were made by the following: Messrs. Bilgram, Van Sickel, T. C. Palmer, Walter Palmer, Stewart, Keeley, Munro, Poyser, and Boyer.

The Conservator reported the gift from the estate of the late Dr. Benjamin Sharp of two microtomes, one a Rivet, the other a sliding microtome.

The following have been elected officers for the year 1921:

Director ..... T. Chalkley Palmer
Vice-Director ..... John A. Shulze
Recorder ..... Charles S. Boyer
Corresponding Secretary ..... Walter Palmer
Treasurer ..... Thomas S. Stewart, M. D.
Conservator ..... F. J. Keeley

CHARLES S. BOYER,
Recorder.

BOTANICAL SECTION.—The Botanical Section has continued to encourage botanical activity at the Academy especially through the meetings of the Philadelphia Botanical Club which have been held in the herbarium during the year.

Officers of the section elected for 1921 at the annual meeting of the section are:

Director ..... Joseph Crawford
Vice-Director ..... Alexander MacElwee
Recorder ..... John W. Eckfeldt, M. D.,
Treasurer and Conservator ..... Stewardson Brown.

ENTOMOLOGICAL SECTION.—The Entomological Section has held its usual meetings which have been well attended. Many interesting communications were made by members and occasional visitors. Mr. David E. Harrower of Philadelphia was elected a member, and Mr. A. B. Heideman a contributor.

The officers and committee elected to serve for 1921 are:
Director .....Philip Laurent
Vice-Director .....R. C. Williams, Jr.
Recorder .....E. T. Cresson, Jr.
Secretary .....J. A. G. Rehn
Treasurer .....E. T. Cresson
Publication Committee: E. T. Cresson, E. T. Cresson, Jr., P. P. Calvert, Ph. D.

MINERALOGICAL AND GEOLOGICAL SECTION.—During the past year, the Section suffered an irreparable loss by the death of its Director, Benjamin Smith Lyman.

Owing to this, and the previous illness of Mr. Lyman, but few meetings were held, and the principal activities of the section were confined to the excursions, which, jointly with the Biological and Microscopical Section, were made every Saturday during the Spring and Fall months.

At the annual meeting the following officers were elected to serve during the ensuing year:
Director, ... F. J. Keeley
Vice-Director ..... T. Chalkley Palmer
Conservator ..... George Vaux, Jr.
Treasurer ..... Dr. Thomas S. Stewart
Recorder and Secretary ..... Samuel G. Gordon.

F. J. KEELEY,
Director.

ORNITHOLOGICAL SECTION.—The Ornithological Section has been active during the year in advancing the ornithological interests of the Academy. The Delaware Valley Ornithological Club has held regular meetings in the ornithological rooms and the Pennsylvania Audubon Society has held two largely attended meetings in the

Lecture Hall with lectures by William L. Finley and Robert Cushman Murphy.

Officers of the Section elected for 1921 are:

Director ..... Spencer Trotter, M. D.
Vice-Director ..... George Spencer Morris
Recorder ..... Stewardson Brown
Secretary ..... William A. Shryock
Treasurer and Conservator ..... Witmer Stone.

Public Lectures.

With the coöperation of the Ludwick Institute two courses of free, illustrated, public lectures were given by members of the scientific staff and others. These were arranged with the object of presenting popular information on the animal and plant life in the vicinity of Philadelphia, on the results of the explorations of the Academy in the west, and upon general biological problems.

In the Monday evening course, January 5 to April 12, Dr. Witmer Stone lectured on "A Naturalists' Camp in the Chiricahua Mountains, Arizona," and on "Birds' Nests and Nesting Habits".

Dr. J. Percy Moore, on "The Foundations of Organic Evolution".

Mr. J. A. G. Rehn, on "Desert Sojourns of an Entomologist" and "Insect Collecting in the Higher Mountains of the West".

Mr. J. Fletcher Street, on "Spring Wild Flowers" and the "Flora of the Pine Barrens and Coast".

Dr. Spencer Trotter, on "The Mammalia".

Dr. H. A. Pilsbry, on "Oysters and the Oyster Industry", and "The Shell Fish of Our Coasts".

Mr. Henry W. Fowler, on "Tropical Fishes".

Twelve lectures were also given in three of the city High Schools on "Local Birds" and "Local Wild Flowers", by Dr. Stone; "Local Insects", by Mr. Rehn; and "The Oyster Industry", by Dr. Pilsbry.

Dr. Stone, Mr. Rehn, and Mr. Fowler also gave voluntary lectures on the local fauna and flora to school children in the Academy Lecture Hall on Friday afternoons, January 16 to February 27.

In the future it is planned to hold all of the lectures at the Academy, to broaden their scope, and to give some of them on Sunday afternoons.

The lectures form a very important part of the Academy's educational work. Through them the attempt is made to bring vividly before the audience the beauties of nature, the life histories of animals, and the laws underlying the development of animal and plant life; and through the aid of lantern slides to bring city children into close contact with the wild life, which many of them have never had an opportunity to study in reality.

Library.

ADMINISTRATION OF THE LIBRARY.

LIBRARY COMMITTEE.

HENRY TUCKER, *Chairman*, F. J. KEELEY,
WITMER STONE, T. CHALKLEY PALMER,
SPENCER TROTTER.

EDWARD J. NOLAN, *Librarian*,*
WILLIAM J. FOX, *Assistant Librarian.*

REPORT OF THE LIBRARIAN.

Owing to the continued illness of your Librarian the duties of the office have again been carried on by the Assistant Librarian, Mr. William J. Fox, to whom I make acknowledgment for the following report.

The additions to the library during the past year total 6927, of which 6046 are pamphlets and parts of periodicals, 693 volumes, and 187 maps. There was also received a framed crayon portrait of the late Professor Henry Carvill Lewis, from Mrs. Edward S. Sayres. These figures show an increase of 2103 over the preceding year, which is mainly due to the receipt of books held back by the late war.

They were received from the following sources:

Isaiah V. Williamson Fund	2810
Exchange	2761
United States Department of Agriculture	542
James Aitken Meigs Fund	206
Authors	67
Editors	54
Pennsylvania State Library	46
Cornell University Agricultural Experiment Station	40

*Deceased Jan. 7, 1921.

New York Agricultural Experiment Station..... 32
Museum of the American Indian, Heye Foundation..... 26
Imperial Department of Agriculture, British West Indies..... 25
Thomas B. Wilson Fund..... 23
American Entomological Society..... 20
Trustees of the British Museum..... 16
Commissão de Linhas Telegraphicas Estrategicas do Matto Grosso ao Amazonas..... 16
State Forester, Virginia..... 13
South Dakota Geological Survey..... 12
Ministerio de Marinha e Ultramar, Commissão de Cartographia, Portugal 11
United States Department of Commerce..... 9
Department of Agriculture, State of California..... 9
Utah Agricultural College Experiment Station..... 8
Maryland Geological Survey..... 7
United States War Department..... 7
Dr. Henry Skinner..... 7
Vermont Agricultural Experiment Station..... 7
United States Department of the Interior..... 6
Albert I^{er}, Prince de Monaco..... 6
Roger Williams Park Museum..... 6
Dr. Edward J. Nolan..... 6
Dr. Henry A. Pilsbry..... 5
Publication Committee of the Academy..... 5
Indiana University..... 5
Board of Water Supply, New York City..... 4
Statens Skogsförsöksanstalt, Stockholm..... 4
San Diego Museum Association..... 4
National Research Council..... 4
California Fish and Game Commission..... 4
Royal Scottish Museum..... 4
Government of India..... 3
Secretaria de Agricoltura y Fomento, Mexico..... 3
F. H. Shelton..... 3
Samuel G. Gordon..... 3
Illinois Geological Survey..... 3
New York State Archeological Association, Morgan Chapter..... 3
Geological Survey of Alabama..... 3
University of Tennessee..... 2
Gouvernements Kina-Onderneming te Tjinjiroen..... 2
Press Bureau, Philippine Mission..... 2
Instituto de Butantan..... 2
Scientific Society of San Antonio..... 2
Ministerio de Agricultura de la Nacion, Argentine Republic..... 2
Direcçion de Montes e Minas, Cuba..... 2
Survey of India..... 2
Georgetown University..... 2

Direcçion de la Edicion Oficial de las Obras y Correspondencia de Florentino Ameghino	2
Serviço Sanitario do Estado de São Paulo	2
Société Hollandaise des Sciences Naturelles	2
Howard Crawley	2
Hawaiian Sugar Planters' Association	2
Texas Agricultural Experiment Station	2
Department of Marine and Fisheries, Canada	1
Pennsylvania Chamber of Commerce	1
University of Wyoming	1
Carleton College	1
Observatorio de Madrid	1
Geological Survey of Georgia	1
Jardim Botanico do Rio de Janeiro	1
Danish Government	1
Tokyo Imperial Museum	1
Dr. Charles W. Richmond	1
Bureau of Topographic and Geological Survey, Pennsylvania	1
Louisiana State Museum	1
Henry Fairfield Osborn	1
Miss Caroline Ziegler	1
Department of Public Works and Buildings, Illinois	1
Commissioners on Fisheries and Game, Mass	1
William J. Fox	1
Zoölogical Society of Philadelphia	1
Wagner Free Institute of Science	1
Mrs. Edward S. Sayres	1
Mechanics' Institute San Francisco	1
Bermuda Biological Station for Research	1
Delaware Institute of Science	1
Michigan College of Mines	1
Cuerpo de Ingenieros de Minas del Peru	1
Southwest Museum	1
Serviço Geologico e Mineralogico do Brazil	1
Munitions Resources Commission, Canada	1
Dr. John V. Fisher	1
St. Louis Natural History Museum Association	1
Warren Academy of Sciences	1
Entomological Society of Nova Scotia	1
Department of Conservation and Development, New Jersey	1
Government of Formosa	1
Dr. William L. Abbott	1
Botanical Survey of South Africa	1
Escola Superior de Agricultura e Medicina Veterinaria, Nictheroy	1
Clarence B. Moore	1
United States Brewers' Association	1

They have been distributed to the various departments of the library as follows:

Journals	5193
Agriculture	681
Geology	321
Geography	201
Botany	113
General Natural History	85
Entomology	86
Voyages and Travels	57
Anatomy and Physiology	42
Mineralogy	37
Conchology	24
Anthropology	22
Ornithology	15
Medicine	11
Bibliography	8
Helminthology	7
Mammalogy	7
Ichthyology	6
Physical Sciences	6
Herpetology	2
Mathematics	1
Philology	1
Miscellaneous	1

The following new journals were added to the library either by purchase or exchange:

Academia Nacional de Ciencias, Cordoba. Miscelanea.
Angewandte Botanik. Berlin.
Ardea. Leiden.
Association française pour l'Avancement des Sciences. Bulletin.
Boston Society of Natural History. Bulletin. Museum Bulletin.
Botanical Memoirs. London.
Botanical Survey of South Africa. Memoir.
Centro de Cultura Scientifica, Pelotas. Revista.
Collegio Pedro II, Rio de Janeiro. Annuario.
Direcçion de Montes y Minas, Habana. Boletin de Minas.
Dorset Natural History and Antiquarian Society, Dorchester. Proceedings.
Eclogae Geologicae Helveticae. Lausanne.
Ethnos. Mexico.
Foreign Commerce Series. New York.
Geologen-Kalender. Leipzig.
Geologiska Kommissionen i Finland. Agrogeologiska Kartor.
Institut General y Tecnico de Valencia. Anales.
Institut d'Egypte. Bulletin. Mémoires.
Journal of Mammalogy. Baltimore.
Museum of the American Indian, Heye Foundation. Indian Notes and Monographs. Leaflets.

National Research Council. Bulletin. Reprint and Circular Series.
Pennsylvania Department of Agriculture, Bureau of Plant Industry. Circular.
Revue Bretonne de Botanique. Rennes.
Revue de Géologie et des Sciences Connexes. Bruxelles.
Royal Scottish Museum. Report.
Serviço Sanitario de Sao Paulo.
Société des Lettres, Sciences et Arts des Alpes-Maritimes. Annales.
South Dakota Geological Survey. Bulletin.
Thoreau Museum of Natural History, Memoir.

A fine copy of the second edition of Elliot, Monograph of the Pittidae, 1893–95, and, Oeuvres Complètes de Buffon (Lacépède), Nouvelle Edition, 17 vols., Paris, 1817–1819, were among the important additions.

Four hundred and ninety volumes have been bound.

Sixty-five pamphlets and parts of periodicals, and 27 volumes were transferred to the Free Library of Philadelphia, not being germane to the Academy's library.

Eleven hundred and six volumes and parts of periodicals were used on the premises by the scientific staff, and 158 volumes were borrowed by members.

My thanks are again due to Miss H. N. Wardle for assistance rendered.

EDWARD J. NOLAN,
Librarian.

Secretaries—Publications.

REPORT OF THE RECORDING SECRETARY.

Meetings have been held December 16, 1919; January 20, February 17, March 16, April 20, and November 16, 1920. Communications were made by James A. G. Rehn, Henry W. Fowler, Stewardson Brown, J. Fletcher Street, Leon L. Gardner, and Henry A. Pilsbry.

Papers for publication have been presented by Henry A. Pilsbry (2), Edgar T. Wherry(2), Morgan Hebard(2), Masamitsu Oshima (2), Francis W. Pennell (2), Henry W. Fowler, Howard Crawley, Samuel G. Gordon, E. Penard, Edward G. Vanatta, Sarah P. Monks, James A. G. Rehn, and H. Newell Wardle.

Four hundred and seventeen pages and 12 plates of the PROCEEDINGS were issued.

The Entomological Section (American Entomological Society) published 403 pages and 18 plates of its TRANSACTIONS; 148 pages and 6 plates of MEMOIRS, and 316 pages and 4 plates of the ENTOMOLOGICAL NEWS.

Part 100, completing volume 25, of the MANUAL OF CONCHOLOGY, consisting of 188 pages and 16 plates, was issued under the direction of Dr. Pilsbry.

Altogether, 1324 pages and 56 plates, were published by the several departments of the Academy during the last year.

Fifty-three members were elected, and 18 have died.

Sets of the publications of the Academy, as far as available, were sent to the Académie de Belgique, and the Université de Louvain, to aid in replacing their libraries destroyed during the war. The distribution of the PROCEEDINGS to several of the European countries affected by the war was discontinued for nearly five years. This accumulation, with the exception of that for Germany, Austria, and Russia, was recently dispatched through the International

Exchange Service. As this medium of transmission is not in a position to forward consignments to Germany and Austria until the peace treaties are finally ratified, the last number of the PROCEEDINGS, 1920, part I, was sent by regular mail, as will be the future issues until the usual method of transmission is again available. Conditions in Russia prevent the sending entirely.

The following were elected members during the past year: Astley P. C. Ashhurst, Edward B. Bartram, W. S. Beach, Charles P. Bower, Frank B. Bower, Hamilton Bradshaw, T. Wistar Brown, 3rd., J. E. B. Buckenham, John Cadwalader, 3rd, Sabin W. Colton, Jr., Francis I. DuPont, Richard Erskine, Childs Frick, Samuel G. Gordon, David E. Harrower, Joseph Hepburn, Joseph S. Lovering, W. G. McDaniel, J. Franklin McFadden, Thomas McKean, Frank R. Mason, William W. Matos, Hugh Bradshaw Meredith, Lawrence J. Morris, Hugh F. Munro, Naomi Pennock, Julian K. Potter, Conrad K. Roland, Benjamin Rush, Arthur R. Spencer, D. W. Steckbeck, George H. Stewart, 3rd., Henry Carlisle Stewart, Henry F. C. Stikeman, J. Fletcher Street, C. E. Tobias, Jr., Harry W. Trudell, Rodney H. True, George F. Tyler, Robert F. Welsh, William Chatten Wetherill, Edward R. Wood, Jr., Anna Woolman, and Edward Woolman.

Acknowledgment is again due to Dr. J. Percy Moore, and to Dr. Philip P. Calvert, who in consequence of my continued illness, have kindly acted at the meetings as Recording Secretary, and Recorder of the Council, respectively. The other duties of the office have been performed by Mr. William J. Fox, who has again compiled this report.

EDWARD J. NOLAN,
Recording Secretary.

REPORT OF THE CORRESPONDING SECRETARY.

During the year the deaths of Sir James A. Grant M. D., and of Colonel William C. Gorgas, U. S. A., were announced. The reported decease of other correspondents was not verified. The following named were elected correspondents: Merrit Lyndon Fernald, Hans Frederick Gadow, Johannes Paulus Lotsy, Daniel Trembly MacDougal, Raymond Pearl, William Emerson Ritter, William Schaus, William Lutley Sclater, and William Berryman Scott.

The Hayden Memorial Medal for 1920, on the recommendation

of a committee of geologists, was awarded and presented to Professor Thomas Chrowder Chamberlin, a correspondent.

Invitations to the Academy to send representatives to the following were received: the postponed International Congress of Meteorology in Venice; the fiftieth anniversary exercises of the Wisconsin Academy of Sciences, Arts and Letters, to which Professor John M. Coulter, a correspondent, was appointed a delegate; the Centennial Educational Conference celebrating the founding of Indiana University; the fiftieth anniversary of the opening of Ursinus College; a private view of exhibits in the new museum of the Buffalo Society of Natural Sciences; the Pan-Pacific Scientific Conference at Honolulu at which the Academy was represented by Dr. Henry A. Pilsbry, and, through the National Research Council, to conferences on scientific exploration and research in tropical America and the Philippine Islands, to which Dr. Witmer Stone was appointed the Academy's delegate. In response to these and other invitations suitable letters of congratulation were sent when appropriate.

Invitations were also received to contribute toward the erection in Strasbourg of a permanent memorial to the distinguished chemist, Charles Gerhardt; and to assist in the restoration of the library of the University of Louvain. Toward the latter a set of the Academy's publications were contributed.

A portrait of the late Professor Henry Carvill Lewis presented by his sister, Mrs. Edward G. Sayres, was suitably acknowledged.

A number of appeals were received from scientific individuals and organizations in Austria and Hungary requesting aid of various kinds, rendered necessary by the deplorable economic conditions in those countries resulting from the war. The Academy was unable to respond to these but the letters are on file and available to any individual member who may wish to contribute.

The corresponding Secretary would again point to the desirability of combining this office with that of Recording Secretary with a view to more efficient handling of the Academy's correspondence.

The following tables present the usual statistics of the correspondence for the year.

Communications received:

Acknowledging the receipt of the Academy's publications	123
Transmitting publications to the Academy	44
Requesting exchanges or the supply of deficienees	12
Invitations to learned gatherings, celebrations, etc	15
Notices of deaths of scientific men	4
Circulars concerning the administrati2n of scientific and educational institutions etc	28
Letters from correspondents and miscellaneous letters	104
Total recieved	330

Communications fowarded:

Acknowledging gifts to the Library	903
Requesting the supply of deficiences	202
Acknowledging gifts to the Museum	71
Acknowledging photographs and biographies	6
Letters of sympathy or congratulation, addresses, etc	8
Diplomas and notices of election of correspondents, and delegates' credentials	18
Miscellaneous letters	120
Annual reports and circulars sent to correspondents	271
Total forwarded	1589

J. Percy Moore,
Corresponding Scretary.

Treasurer.

SUMMARY OF THE ACCOUNTS OF GEORGE VAUX, JR., TREASURER OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, FOR THE FISCAL YEAR ENDING NOVEMBER 30, 1920

GENERAL FUND.

RECEIPTS.

Income from Investments		$38,112.96
Income from Estate of John Turner, dec'd		140.34
Annual Dues		2,170.00
Interest on Bank Balances		329.69
Publications sold		545.80
Income Account of 1309 Arch Street		1,193.23
Proceeds of sale of Minerals		250.00
Transfers from Funds:–		
Jeanes Fund for Museum Expenses	$ 900.00	
Wilson Fund for Librarian's salary	300.00	
A. H. Smith Fund	1,584.00	
M. R. D. Smith Fund	300.00	
H. N. Potts Fund	500.00	
Jessup Fund, Male Branch	510.00	
		4,094.00
		$46,836.02

PAYMENTS.

Balance overdraft 29th November 1919	$1,939.81
General Expenses	3,523.25
Petty Expenses	300.00
Books	123.56
Binding	798.00
Recording Secretary	249.42
Printing PROCEEDINGS	1,780.62
Specimens and Expeditions	2,493.86
Expenses of Treasurers' Department	515.00
Salaries in Curators' Department	26,051.29

Salaries in Librarian's Department	4,711.18
Mary S. Warren, on account of 1309 Arch Street	1,800.00
Estate of Robert H. Lamborn, dec'd., for taxes etc. on lands in Colorado	655.10
Corresponding Secretary	25.00
Balance on hand 30th November, 1920	1,869.93
	$46,836.02

CONCHOLOGICAL SECTION FUND.

RECEIPTS.

Balance overdrawn 29th November 1920	$1,304.96
Net Income collected	621.31
	$1,926.27

PAYMENTS.

Balance overdrawn 30th November, 1919	$1,726.27
Cash to S. Raymond Roberts	200.00
	$1,926.27

COPE COLLECTION FUND.

RECEIPTS.

Balance 29th November, 1919	$1,582.23
Net Income collected	782.87
Balance 30th November, 1920	$2,365.10

F. V. HAYDEN MEMORIAL FUND.

RECEIPTS.

Balance on hand 29th November, 1919	$104.51
Net Income collected	102.22
Balance overdrawn 30th November 1920	50.99
	$257.72

PAYMENTS.

Cash to William Evans Wood for medal awarded to Thomas Chrowder Chamberlin, Ph. D., LL. D	$257.72
	$257.72

HORACE N. POTTS FUND.

RECEIPTS.

Balance on hand 29th November 1919	$4,873.88
Net Income collected	41.64
	$4,915.52

PAYMENTS.

Cash transferred to Girard Trust Company, being proceeds of sale of Potts Farm	$4,358.36
Cash transferred to General Fund in accordance with appropriation.	500.00
Balance on hand 30th November, 1920	57.16
	4,915.52

MARY JEANES MUSEUM FUND.

RECEIPTS

Balance on hand 20th November, 1919	$ 61.48
Net Income collected	851.61
	$913.09

PAYMENTS.

Transferred to General Fund for Museum Expenses	$900.00
Balance on hand 30th November, 1920	13.09
	$913.09

JESSUP FUND, MALE BRANCH.

RECEIPTS.

Balance on hand 29th November, 1919	$924.50
Net Income collected	630.03
	$1,554.53

PAYMENTS.

Salaries to Students	$360.00
Transferred to General Fund in accordance with appropriation	510.00
Balance on hand 30th November, 1920	684.53
	$1,554.53

JESSUP FUND, FEMALE BRANCH.

RECEIPTS.

Balance on hand 29th November, 1919	$110.17
Net Income collected	222.86
	$333.03

PAYMENTS.

Salaries to students	$240.00
Balance on hand 30th November, 1920	93.03
	$333.03

J. A. MEIGS LIBRARY FUND.

RECEIPTS.

Balance on hand 29th November, 1919	$612.89
Net Income collected	520.24
	$1,133.13

PAYMENTS.

Books purchased	$970.27
Balance on hand 30th November, 1920	162.86
	$1,133.13

J. H. REDFIELD MEMORIAL FUND.

RECEIPTS.

Balance on hand 29th November, 1919	$165.27
Net Income collected	171.92
	$337.19

PAYMENTS.

Stewardson Brown, Treasurer of Botanical Section	$165.27
Balance on hand 30th November 1920	171.92
	$337.19

MARY REBECCA DARBY SMITH FUND.

RECEIPTS.

Balance on hand 29th November 1919	$350.40
Net Income collected	62.61
	$413.01

PAYMENTS.

Transferred to General Fund in accordance with appropriation.....	$300.00
Balance on hand 30th November, 1920.....	113.01
	$413.01

AUBREY H. SMITH FUND.

RECEIPTS.

Balance on hand 29th November, 1919.....	$2,594.13
Net Income collected.....	735.52
	$3,329.65

PAYMENTS.

Transferred to General Fund in accordance with appropriation.....	$1,584.00
Balance on hand 30th November, 1920.....	1,745.65
	$3,329.65

FRANCIS LEA CHAMBERLAIN FUND.

RECEIPTS.

Balance on hand 29th November, 1919.....	$369.55
Net Income collected.....	110.83
Balance on hand 30th November, 1920.....	$480.38

THOMAS B. WILSON FUND.

RECEIPTS.

Balance on hand 29th November, 1919.....	$317.37
Net Income collected.....	467.78
	$785.15

PAYMENTS.

Books purchased:.....	$250.00
Transferred to General Fund for Librarians' Salary.....	300.00
Balance on hand 30th November, 1920.....	235.15
	$785.15

WILLIAM S. VAUX FUND.

RECEIPTS.

Balance on hand 29th November, 1919	$1,296.88
Net Income collected	525.90
	$1,822.78

PAYMENTS.

Minerals purchased	$261.35
Balance on hand 30th November, 1920	1,561.43
	$1,822.78

I. V. WILLIAMSON FUND.

RECEIPTS.

Balance on hand 29th November, 1919	$ 540.59
Net Income collected	1,666.59
	$2,207.18

PAYMENTS.

Transferred to Girard Trust Company, balance income in this account for investment	$ 540.59
Books and journals purchased	1,628.08
Balance on hand 30th November, 1920	38.51
	$2,207.18

SPECIAL DONATIONS.

RECEIPTS.

Balance on hand 29th November, 1919	$589.38
Received from "A Friend" for the purchase of birds	100.00
Balance on hand, 30th November, 1920	$689.38

J. F. BEECHER MEMORIAL LABORATORY FUND.

RECEIPTS.

Balance on hand 29th November, 1919	$1,511.21
Net Income collected	718.62
	$2,229.83

GENERAL ENDOWMENT FUND.

RECEIPTS.

Balance on hand 29th November, 1919	$194.11
Net Income collected	179.68
	$373.79

Respectfully submitted,

E. and O. E.
Philadelphia.
November 30, 1920.

GEORGE VAUX JR.,
Treasurer.

We herewith report that we have made an audit of the books and accounts of George Vaux, Jr., Esq., Treasurer of the Academy of Natural Sciences of Philadelphia, for the fiscal year ended November 30th, 1920.

As a result of our audit we certify that the above statements are in accord with the Treasurer's books and are in our opinion correct.

All the income received during the year was properly accounted for and entered upon the books. The payments, as shown by the Cash Book, were properly supported by statements, checks, or vouchers, and were found to be correct. A reconciliation of the deposit account with the Girard Trust Co., was made by us and the correctness of the Cash Balance as shown by the Treasurer's books verified thereby.

(Signed) Edward P. Moxey & Co.,
Certified Public Accountants

REPORT OF THE TREASURER OF THE MANUAL OF CONCHOLOGY

The Treasurer of the "MANUAL OF CONCHOLOGY" respectfully reports that:

During the year ending December 1, 1920, the receipts from all sources were		$ 969.79
And disbursements		1,006.93
Leaving a deficit of		$37.14
Deducting this from balance on hand December 1, 1919		220.95
Leaves balance December 1, 1920		$183.81
Divided "Manual" account	$28.06	
Special Deposit Wesley and Son, London	155.75	$183.81

The receipts were as follows:

From Collections for account Vol. XXIV	$8.00	
" Collections for account Vol. XXV	496.76	
" Sale of back volumes and parts	234.05	
" The Academy of Natural Sciences	200.00	
" Henry A. Pilsbry	25.00	
" Interest on daily Bank Balances	5.98	
		$969.79

The disbursements were:

For Colorists	$90.00
" Lithographing and sizing plates	299.32
" Paper and printing	409.24
" Postage and expressage	21.45
" Advertising	4.00
" Purchase of back volumes	80.00
" Protested draft,	76.42
" Transfer from Deposit Account Wm. Wesley and Son for parts 96, 100	26.50
	$1,006.93

The Publication Committee of the Academy having assumed payment of salaries of Editor, Conservator, and Draughtsman, the "Manual" is relieved of a large item of expense, and the payments made by its Treasurer are now confined to cost of manufacture and issue of the parts.

E. and O. E.

Respectfully submitted,

S. RAYMOND ROBERTS,
Treasurer.

December 1, 1920

ANNUAL REPORTS

The Academy of Natural Sciences

OF

Philadelphia

FOR THE YEAR ENDING NOVEMBER 30, 1921.

EXPLORATIONS
NATURAL HISTORY MUSEUM
SECTIONS
PUBLIC LECTURES
LIBRARY
SECRETARIES
PUBLICATIONS
TREASURER

PHILADELPHIA
1922

ANNUAL REPORTS

The Academy of Natural Sciences

OF

Philadelphia

FOR THE YEAR ENDING NOVEMBER 30, 1921.

Officers and Council 1922.

President

JOHN CADWALADER.

Vice Presidents.

EDWIN G. CONKLIN, HENRY SKINNER.

Recording Secretary, JAMES A. G. REHN.

Corresponding Secretary, J. PERCY MOORE.

Treasurer.

GEORGE VAUX, JR.

Librarian.

SPENCER TROTTER.

Curators.

WITMER STONE, GEORGE SPENCER MORRIS,*

HENRY A. PILSBRY, HENRY TUCKER.

Additional Members of the Council.

Class of 1922.

ROBERT G. LECONTE, GEORGE L. HARRISON, JR.,

MORGAN HEBARD, MILTON J. GREENMAN.

Class of 1923.

CHARLES B. PENROSE, WILLIAM E. HUGHES,

CHARLES MORRIS, ROSWELL C. WILLIAMS, JR.

*Since deceased.

Class of 1924.

PHILIP P. CALVERT, WALTER HORSTMANN,
FRANK J. KEELEY, T. CHALKLEY PALMER.

COMMITTEES 1922

Committee on Accounts (elected by the Academy, December 19, 1921): Charles Morris, *Chairman*, Samuel N. Rhoads, John G. Rothermel, Thomas S. Stewart, Walter Horstmann.

COMMITTEES ELECTED BY THE COUNCIL, DECEMBER 27, 1921.

Finance: Effingham B. Morris, *Chairman*, Walter Horstmann, George L. Harrison, Jr., Morgan Hebard, and the Treasurer.

Publications: Henry Skinner, *Chairman*, Witmer Stone, Henry A. Pilsbry, William J. Fox, Milton J. Greenman.

Library: Witmer Stone, *Chairman*, Henry Tucker, Frank J. Keeley, T. Chalkley Palmer, Spencer Trotter.

Instruction: Henry Skinner, *Chairman*, Henry A. Pilsbry, Charles Morris, George Spencer Morris, James A. G. Rehn.

COMMITTEES APPOINTED BY THE PRESIDENT.

Policy: Edwin G. Conklin, *Chairman*, Richard A. F. Penrose, Jr., Milton J. Greenman, J. Percy Moore, George Vaux, Jr., G. E. de Schweinitz, Witmer Stone, Effingham B. Morris, George L. Harrison, Jr.

Hayden Memorial Medal Award: Richard A. F. Penrose, Jr., *Chairman*, Edgar T. Wherry, Henry Fairfield Osborn, Charles D. Walcott, John M. Clarke.

By-Laws: Spencer Trotter, *Chairman*, Charles B. Penrose, Walter Horstmann.

Nomination of Correspondents: Henry Skinner, *Chairman*, Witmer Stone, J. Percy Moore.

Special Reports by Members of the Scientific Staff Based on Recent Explorations Conducted in the Interests of the Academy.

MINERAL COLLECTING IN THE ANDES.

(The Vaux-Academy Andean Expedition of 1921)

BY SAMUEL G. GORDON.

It was the writer's privilege to make a trip through the Andes from Ecuador to Chile during the summer and autumn of 1921. The expedition was made primarily to secure mineral specimens for the William S. Vaux Collections in the museum of The Academy of Natural Sciences of Philadelphia, and to obtain material for crystallographic research in the laboratory of the Academy. Incidentally a collection of Andean rocks of much interest was secured. As the scientific results will be published in a series of mineralogical and petrographic papers in the PROCEEDINGS of the Academy, the present account covers merely the itinerary and observations of general interest made during the trip.

The South American Cordilleras, aside from their scenic beauty, present much of interest to the traveller who desires to delve into their scientific aspects. To the geologist, the structural features of the great mountains and the volcanic phenomena manifest in many parts of the Andes, present problems whose study form attractive field; and in no less degree alluring to the mineralogist are the interesting mineral species which have been discovered in the various Andean mines, many of them of unusual composition, or crystal form.

It is of course impossible to present a detailed account of a trip so crowded with incidents and we shall therefore touch only upon such localities, or happenings that are of exceptional interest.

After eight hours passage through the Panama Canal, our vessel the "Huallaga" entered the beautiful bay of Panama, steamed past Taboga Island, and headed southward for that much maligned city, Guayaquil.

Guayaquil lies about sixty miles up the sultry Guayas River. The houses of the city are built of painted plaster on a framework

CHIMBORAZO, ECUADOR

of bamboo, so that the general effect is that of a stage scene, rather than of substantial residences. Beyond the city, the houses are built entirely of bamboo, but supported on stilts.

There is a railroad from Guayaquil to Quito, the capital, situated on the plateau in the interior. A small river steamer takes one across the wide Guayas River to Duran. After passing through dense tropical growths, in which plantains are most in evidence, the train begins the ascent to Riobamba, one of the more important towns on the plateau. This part of Ecuador is quite picturesque. The roads are hedged with cactus, and on clear days one may obtain fine views of Chimborazo, Altar, and Tunguragua. The plateau from Riobamba to Quito was called the Avenue of Vol-

canoes by Whymper from the thirty or more peaks which dominate the landscape. One of the best known is Cotopaxi, considered to be the highest active volcano known with an altitude of 19,600 feet, and now and then adding to it. Others, Iliniza, Corazon, Antisana, and Cayambe on the equator, are no less beautiful.

Quito is situated at the foot of the volcano Pichincha, which possesses several craters. A trip was made to the largest one, only to find it entirely enveloped in fog.

The Peruvian coast, south of Ecuador is extremely arid and consists of reddish and yellowish cliffs backed by low, barren hills. Occasionally a rift in the clouds will reveal a snow-capped peak in the far-off Andes. A few oases occur where small streams, arising in the mountains, descend to the coast. About the only life to be seen are the thousands of sea-birds circling about the numerous guano islands, or an occasional school of seals sporting in the sea.

The coastwise steamers make numerous stops, perhaps to take on a load of cattle or hogs for the Lima market. In many cases cattle are driven a journey of four or five days from the interior, and then loaded on steamers bound for Callao. From the beginning of the drive to their slaughter they receive no food.

By this time our steamer had on board, in addition to the cabin passengers, a quantity of Indians and Cholas, fifty or sixty Chinese immigrants, a great number of cows, pigs, sheep, chickens, and ducks, two goats, a monkey, and a few odd parrakeets.

Five days after leaving Quayaquil the steamer entered the harbor of Callao, the chief seaport of Peru. The boat was immediately surrounded by a number of launches from which swarmed hundreds of fleteros, or porters. Their charge for taking passengers and baggage ashore depends largely on the appearance of the passenger, and his familiarity with their language and rates, so that it soon occurs to one that they must be the direct descendents of Pizarro's piratical band. When the demand for Conquistadores was over, they perhaps entered the fletero business.

Lima is situated but half an hour's ride from Callao. However charming this city may be in summer, it is far from being a pleasant place in the winter season, due to the heavy mist and fog that is always present.

The Central Railroad ascends the Andes to Aroya by means of a great number of tunnels and switchbacks. Branches continue the road to Morococha, Huancayo, Goyallarisquisqua, and Cerro de Pasco. Soon after leaving Lima, the fog and clouds are left below. At Chicla the snow-capped peaks come into view, and rapidly it becomes cold. Ticlio, the summit, 15,665 feet in altitude, was reached late in the afternoon. The rarity of the atmosphere cast a pall over the passengers, with here and there a sign of distress, or perhaps a frown at the crazy gringo who insisted on keeping

CUZCO, PERU.

the window open. At Aroya a change of cars is made for Cerro de Pasco, several hours ride across the plateau.

Cerro de Pasco is 14,500 feet in altitude, and the native town apparently glories in the reputation of being the dirtiest town in the world.

This part of Peru contains its richest mines, for here are situated the important copper and silver districts, Cerro de Pasco, Morococha, and Casapalca; and the coal mines of Goyallarisquisqua, Quisquacancha, and Oyon. Aside from their great economic importance, the districts are of interest to the mineralogist because of the superbly crystallized enargite, tetrahedrite, and bournonite, which are frequently found.

A day and a half's ride on the faster steamers is sufficient to take one from Callao to Mollendo in southern Peru. The port is but an open roadstead, and steamers, as usual, anchor far out. From Mollendo it is half a day's ride to Arequipa, and two and a half days to Cuzco.

As one approaches Arequipa, the Pacific is left far below, and the volcano Misti appears above the horizon. The country traversed is extremely monotonous, save for the distant volcanoes and the many symmetrical crescent shaped sand dunes, often beautifully

INCA CAVERN, CUZCO, PERU.

ripple-marked. Arequipa lies at the foot of Misti, and enjoys an almost perfect climate.

The ride to Cuzco is quite uninteresting until Sicuani is reached. The railroad then follows the Vilcanota River, through a rich agricultural valley, where cultivation has been extended by ancient terraces to the steep hillsides above.

Early one evening we arrived at Cuzco, and boarded a small car drawn by a mule.

The ruins in Cuzco consist largely of the walls of the palaces of the Incas, which line many of the streets, and on which have been grafted many later structures. Of particular interest is the Temple of the Sun, the Convent of La Merced, perhaps the most ornate of the Spanish structures, and Ccoleccompata which contains

what remains of the palace of Manco Capac, the first Inca,—perhaps one of the finest bits of masonry known.

To the northwest of Cuzco is a steep hill on top of which are the massive fortifications of Sacsaihuaman; and still farther north a small knob, known as the rodadero, of great interest to the geologist as an exceptionally fine example of slickensiding. At this place the rock has been carved into what is now called the Inca's

CHOJÑACOTA: THE BOLIVIA OF THE IMAGINATION.

seat. It is not unlikely that much of the overlying rock and soil was removed to expose the grooving so well.

About a mile east of the fortifications is a curiously carved hill of limestone known as the Chinganas. Beneath the hill is a cavern on one side of which is a sort of altar, and opposite it a seat. In the rear is a chimney which lets light down from the surface.

Unfortunately the writer had not time to visit Pisac, Ollantytambo, Machupichu, and the various islands of Lake Titicaca which abound in Inca and pre-Inca ruins.

It is a long day's ride to Puno on Lake Titicaca, a journey across which brings one into Bolivia. At Puno the Peruvians examine all the baggage. This performance is repeated by the Bolivians on the other side of the Lake. Here we meet also the Bolivian consul.

Before leaving Philadelphia the Bolivian consul had vised my passport. This paragon of virtue, however, insisted that the Philadelphia consul's vise was worthless, and therefore charged me four soles for another.

Lake Titicaca is about the size of Lake Erie, and 12,500 feet above the sea. A fine lake steamer, the "Inca," leaves Puno in the evening, and arrives at Guaqui early the next morning. It was a clear moonlight night when we crossed, but so cold that the

GLACIERS OF CHOJÑACOTA, BOLIVIA.

decks were soon deserted. It is not strange that the Incas were sun-worshipers!

At Guaqui connection is made with the train for La Paz, the capital of Bolivia. Soon after leaving the lake, Tiahuanaco, famous for its monolithic pre-Inca ruins, is passed.

After a short ride, the ice-covered range forming the eastern Cordillera may be seen in the distance. La Paz lies in the canyon of the La Paz river, about 1,500 feet below the level of the plateau. To the south is Illimani, one of the highest mountains in South America, about 21,500 feet. The distant walls of the canyon are eroded into peculiar and fantastic forms.

La Paz is quite a modern city, but one of great contrasts, for here one may meet Europeans elbowing Indians on the pavements, while in the narrow streets llamas gaze haughtily at the clanging

trolley cars in dispute of the right of way. In the Grand Hotel Paris on the plaza, one may even find running water, which the best hotels in Lima cannot boast of. In these countries the majority of the hotels are named Grand Hotels, much as our local hostelries are called Mansion houses, but in Latin America the names are of even less significance.

Bolivia is essentially a mining country, notably rich in deposits of tin, silver, bismuth, tungsten, and copper. While modern methods are employed in the largest mines, those in the smaller ones are primitive indeed. In the latter type a tunnel is situated far up on a mountain side, reached by a narrow trail. The ore is carefully handpicked by Indian women and sent down on wire cables in buckets made of cow-hide. Within the mines, Indians may be employed to turn the wooden drums with which the ore is hoisted in the winzes. In many cases the mines are situated at altitudes of 12,500 to 16,000 feet, or even 17,000 feet, frequently near picturesque glaciers or ice-covered peaks, about which great condors may frequently be seen to soar.

The principal method of travel in Bolivia beyond the *ferrocarril* is by means of a pack-train and an *arriero* whose chief duty is to keep the mules going in the right direction. This is accomplished chiefly by means of his calloused toe, or by specimens of such rocks as may be close at hand.

Northeast of La Paz is the mining district of Huayna Potosi, so called from a beautiful snow-capped granitic mountain, about which the deposits of tin and bismuth occur.

More important, however, are the Quimsa Cruz and Araca districts lying southeast of Illimani.

Fiestas form the most important part of Bolivian life, and the Bolivian calendar is liberally filled with them. The Indians begin celebrating about a week before the holiday in anticipation of the event, and by that time become so enthused that it is another week before the celebration is over. About that time another fiesta is in sight.

The natives don costumes for the occasion, frequently coats made of ocelot skins. Bands composed essentially of large drums and reed instruments parade continuously about the villages. The music is very monotonous as it runs pretty much to the same tune.

When the writer arrived in Oruro, the celebration was still in progress. Of chief interest seemed to be the bull-fight, and most of the population was gathered at the bull-ring, or thickly scattered on the hill overlooking it. Belts of money are tied on a bull, which is let into the ring. Then, anyone who is desirous of increasing his wealth to the extent of a few centavos, is privileged to help himself. Our sympathies are naturally with the bull, and when occasionally one turns and bowls over an Indian our interest increases, and we admit that it is not such bad sport after all.

Oruro is the mining center of central Bolivia. Some distance to the southeast is the district of Huanuni which is of interest as furnishing the rare germanium-bearing minerals cylindrite and franckeite. Still farther southeast is Llallagua, the world's greatest producer of tin. Adjacent to it are the similar mines of Uncia.

Two days distant by mule are the old silver mines of Colquechaca. The road leads out from Uncia, across a pampa, towards the distant range. On the way, one meets many Indians trudging into Uncia for the Sunday market, some with considerable loads, others idling along, strumming carelessly on musical instruments made from the backs of armadillos.

After a long day's ride you arrive at a tambo. A tambo is a low building of adobe, with a thatched roof, and one or more rooms. On each side of the rooms is a couch of adobe brick. If you are not fortunate enough to carry a bed, the llama skins masquerading as saddle blankets on the mules are thrown on the bricks. Late in the afternoon of the second day Colquechaca appeared in sight, and we were soon clattering down the old cobbled streets. The mines in former days were exceedingly rich in argentite, pyrargyrite and argyrodite.

Potosi is the most celebrated mining district of Bolivia, as it is reputed to have produced over a billion ounces of silver. According to the old Spanish laws, claims or boca-minas could be obtained for the modern equivalent of a few bolivianos per hectare. The holder of a boca-mina was permitted to tunnel in any direction until he ran into a tunnel belonging to someone else. As a consequence, mining on Potosi Mountain is a history of continual warfare between the boca-minas. The visitor finds much of interest also in the great number of ornate old Spanish iglesias. At the colorful native market, the opportunity is presented of seeing types

of Indians from various parts of the plateau and the montaña.

In southern Bolivia are the important silver mines of Pulacayo and Chocaya, and the tin, bismuth and tungsten mines of Chorolque and Tasna. The latter produces most of the world's supply of bismuth.

The Andes forming the boundary between Chile and Bolivia and Argentina include a large number of volcanoes. At Ollagüe is a volcano of the same name, alleged to have an altitude of 18,200 feet. It exhibits fumarolic activity. The rock is largely andesite. From the fumarole the vapor rushes with a terrific roar. About the small vents the rocks are coated with beautiful deposits of greenish-yellow and orange-colored sulphur.

A short distance south of Ollagüe is the great borax deposit of Ascotan.

The volcano San Pedro also exhibits some fumarolic activity. At its foot is a small but symmetrical volcano which from the distance looks like a museum-sized specimen. This cone is of recent origin and the erupted material consists largely of olivine basalt.

On the hills northeast of Calama are the extensive copper deposits of Chuquicamata, which are noted among mineralogists for the many rare sulphates produced.

Further southeast is a small town in the desert called Sierra Gorda. Sierra Gorda is a collection of calamena shacks upon which the sun burns ceaselessly. The town appears to be largely deserted, and the few inhabitants remaining seldom venture out into the sandy stretches which form the few streets. In either direction across the desert are some low hills, in which there was formerly considerable mining. The district is of interest as having formerly produced some exceedingly rare sulphates.

Not far from Sierra Gorda one meets the first nitrate oficina, the Oficina Aconcagua, and is well into the Atacama desert. There are but few oases in this great desert whose length is about a thousand miles. Copiapo, the most important one, is situated in the southern part of the desert, and formerly was the center of a very important mining district.

One may sail for days along the coast which contains but a few towns whose existence is due solely to the nitrate industry. Antofogasta is the most important of these. It obtains all its water

by a pipe line from some small lakes fed by melting snows of a few volcanoes in the Andes, 250 miles distant.

The whole coast is very unstable, and subject to frequent earthquakes. On several occasions the writer has had to talk on this subject, and on this trip he had hoped to experience a good earthquake so that in the future his remarks would contain a little personal experience on the subject. But unfortunately, the earthquakes were not functioning when he was there, and this was the one regretful part of the trip.

COLLECTING GRASSHOPPERS IN THE SOUTHERN ROCKIES AND THE PLAINS.

BY JAMES A. G. REHN.

As long ago as the year 1905, Mr. Morgan Hebard, now a Research Associate and Councilor of the Academy, and the writer conceived the ambitious project of carrying out a field reconnaissance of the United States, solely with the object of securing material and information for a contemplated monographic study of the Orthoptera of that region. The Orthoptera are the order of insects which embraces the cockroaches, mantids, phasmids or walking-stick insects, short-horned grasshoppers, katy-dids or long-horned grasshoppers, and the crickets. Since 1907 this work has been carried on with considerable regularity and with the most satisfactory results.

To date the field activities have necessitated individual travel of over sixty thousand miles in train and automobile, aside from saddle, pack-train and foot travel. During portions of the years 1907, 1908, 1909, 1910, 1911, 1912, 1913, 1915, 1917, 1919 and 1921, a total of eighteen months has been spent in the field in this study. Financially the support for this work has been almost entirely supplied by Mr. Hebard, and very largely through similar assistance the preparation of the vast collections secured has been made possible.

The material secured to date comprises over ninety-two thousand specimens, all of which will remain in the custody of the Academy, in its own collection and as the depository of the Hebard Collection, until study work has been completed, and duplicate series distributed to other institutions which have assisted by the loan of

valuable and important material. Reports have been published in the Academy's PROCEEDINGS upon the collections secured in 1905, 1907, 1908, 1911 and 1913, while special and critical papers on certain groups, utilizing material secured other years, have also been published. A number of extensive papers, preliminary to to the final work, are also in course of preparation or projected.

In addition to the collections made by Hebard and Rehn, others totalling many thousands of specimens from important regions in the United States have been secured from thoroughly responsible collectors, and in this way a representation of close to two hundred thousand pinned and labelled specimens of North American Orthoptera has been made available for study. The detailed and exact examination of such a collection requires years, and it also involves an almost incredible amount of painstaking labor. In consequence tangible scientific results of the work are but slowly becoming evident.

The areas selected for the field work of 1921 were sections of northern New Mexico, the "Panhandle" and Staked Plains region of Texas, Oklahoma and eastern New Mexico, and southwestern Colorado. Much work had been done by us in previous years in Texas, but no locality in the "Panhandle" had been examined, while we wished very greatly to compare the Orthoptera of the Staked Plains with those of the more typical Great Plains to the northward. Northeastern New Mexico was the original locality of certain species described nearly fifty years ago, and these to-day are among the forms concerning which we have but little information. In addition, in the last mentioned region we wished to secure information on the passage from a true desert fauna to a campestrian or plains assemblage. Southwestern Colorado is a region which has had but a limited amount of entomological study. The relative detachment of its high mountains, and the penetration of the region by a pronounced desert element of Painted Desert origin, made its examination hold more than usual interest.

Perhaps to most people grassy plains would be considered ideal localities for grasshoppers, and with very good reason, but many forms, and these in consequence often the least known and most local species, are limited to high mountain meadows, the grassy glades of the Canadian Zone forests and the natural gardens of the Hudsonian Zone, or even the bare rocks of the peaks above the

timber line. Others are found only in the shade of deep forests, while vast numbers of species are at home under the blaze of a desert sun. In consequence regions as diverse as below sea-level in Death Valley, and the summit of Mount Whitney at 14,500 feet in the Sierras, the lowest and highest points within the United States, have required examination in our work. In the field season of 1919 a most striking new species of grasshopper was found in the former locality, and an even more remarkable new genus and species of katy-did was secured on the latter summit.

Leaving Philadelphia July 31, 1921, the writer spent the first twenty days of the trip working alone, Mr. Hebard joining him at Amarillo, Texas, on August 20. The first stop was made at Syracuse in the Great Plains region of western Kansas, where a sandhill area south of the Arkansas River was examined. Raton, New Mexico, was the next work center and there a study of conditions on the Raton and Johnson Mesas, as well as the adjacent plains to the south, occupied the time. Remnants of a very old lava sheet, these and similar mesas, or table-topped ranges, project to the east of the Rockies for many miles, forming a decided barrier to north and south travel. Thanks to the erosion-resisting capping of hard volcanic material, which in much of this region overlays one of the most important coal deposits in the Western States, the summits of several of these mesas are very level and plains-like. These areas are splendid pasture land, or in large part cultivated, receiving more rain in summer and snow in winter than the lower plains. The plains to the southeast and south of Raton are dominated by isolated volcanic peaks, such as Mt. Capulin and Eagle Tail Peak, reminders of the days, far more recent than those of the crusting of the Raton Mesa, when these regions were in the throes of volcanic activity.

A brief stop at Wagon Mound, New Mexico, gave an opportunity to study the grasshopper fauna of several volcanic cones nearby, one of these hills from its fancied shape having supplied the early Anglo-Saxon pioneers with the name now applied to the town. In quest of additional information upon certain species which had been secured there in previous field work, several days were spent in the vicinity of Albuquerque, working in the flood-plain of the Rio Grande, on the bench toward the Sandia Mountains, and in an extensive sand area west of the river. A brief side trip to Holbrook,

Arizona, and Gallup, New Mexico, on their respective sides of the New Mexico-Arizona state line and both west of the Continental Divide, was productive of important information from the region of a limited fauna.

At Gallup were secured two specimens of one of the strangest meloid or oil-beetles known from our country. Resembling nothing so much as an inflated bladder about an inch long, barred with cross stripes of black and blood-red, and with wings and wing-covers reduced to a functionless minimum, this unusual beetle was scrambling over the stony hillside. The species is one of the genus *Megetra*, a truly remarkable member of a family of beetles containing many weird and striking forms. One of the katy-dids sought at both Albuquerque and Holbrook is of infrequent occurrence in spiny desert vegetation. The species is flightless and very protectively colored, so the search is a constant and unremitting examination of the clumps of wiry scrub or brittle brush. Ocular examination must be accompanied by "beating," which is an energetic brushing of the shrubbery with a heavy sheeting net supported by a very strong and yet resilient spring steel frame. As this is carried on steadily hour after hour, the reader can appreciate the collector's evening rest is fully earned. In fact, probably two-fifths of all the Orthoptera to be secured in the western United States must be taken in this way, and almost an equal amount by similar "sweeping" of grasses and low annuals. The species taken by individual location and stalking, or in flight, are far fewer than the uninitiated would suppose. There is little of the delicacy of butterfly catching in Orthoptera collecting, instead more of the swing of the reaper with a suggestion of the carpet beater.

The Plains of eastern New Mexico were examined at Vaughn and Tucumcari,—the latter pronounced Twó-cum-carey. Vaughn is quite high for the Plains–6000 feet–and it was not as satisfactory a locality as Tucumcari, which is at less than 5000 feet elevation. At the latter locality a number of species which we were extremely anxious to secure from this general region were taken. Here to the west bench-like mesas break the uniformity of the plains, which are otherwise quite level, unlike at Vaughn, where they are rolling downs.

In order to determine more clearly to what extent the orthopterous fauna of the Staked Plains differs from that of the surrounding

regions to the east and north, a locality to the north, one to the northeast and one to the east were studied. To the northeast at Guymon, in the "Panhandle" of Oklahoma, a strong tincture of forms from the lower country to the east and in Texas was evident. The variety of species and abundance of individuals made Guymon an interesting locality, one of absolutely level plains with richer vegetation than in the Kansas Great Plains. Dalhart, Texas, was the locality to the north of the Staked Plains, and Childress, Texas, the one to the east. With an elevation of little more than 2000 feet

STAKED PLAINS AT HAPPY CROSSING, PALO DURO CANYON, NEAR AMARILLO, TEXAS.

the latter locality showed but a weak plains element, with a strongly indicated central Texas influence. After the high plains Childress was quite hot, while its human inhabitants showed a similar relationship to that of the fauna, i. e. central Texan and not Great Plains.

The Staked Plains of Texas and eastern New Mexico next occupied our attention, using the term for the area east of the Pecos and south of the Canadian Rivers, as generally restricted. The surface of the Staked Plains is monotonously level with no true trees except where planted, and shrubby growth, such as mesquite, in relatively few areas. There is little surface running water, but the few streams which penetrate or rise in this region have carved deep and broad gashes in the limestone surface of the Plains. One

comes suddenly and without warning upon these canyons, which are sometimes several miles wide and some hundreds of feet deep. In their bottoms are groves of good sized trees, chiefly cottonwoods, along a channel which carries a trickle of water, swelling after rains to a considerable stream. Palo Duro Canyon, near Amarillo, is such a place, and there, along the Prairie Dog Fork of the Red River, we spent some most interesting and profitable hours. The fauna of these canyons, like their flora, was probably derived in large part from country lower down stream, and represents an extension into a region of very different conditions on the plains level. At Amarillo, Mr. Hebard joined the writer, and six localities in the Staked Plains were carefully studied.

The vicinity of Canadian, Texas, in the valley of the Canadian River proved to be a most interesting district. North of the river were high sandhills, which would strictly be called "Great Plains" on account of their position and general character, while the bluffs on the South side of the river were virtually the north escarpment of the Staked Plains. On the bluffs we had the good fortune to take some greatly desired specimens of a most interesting "crackler" grasshopper, a northern type which had never before been taken in Texas. The genus to which this species belongs has the interesting habit of performing aerial dances and while so doing giving a sharp penetrating crackling note. This is accomplished by the rubbing of certain thickened veins of the wings one over another, and some of the species have very different notes, recognizable at once to the close student. As this is one of the genera which we have been critically studying for some years its presence is always a guarantee of excitement, for the insects are very active and generally wary, while the rocky and often dangerous slopes which they frequent are not preferred places for the necessary acrobatics. On the sandhills at Canadian many very interesting things were taken in their grass cover, and mantling thickets of wild grape and other plants. One of the strangest and most striking katy-dids found in the United States, was found in fair numbers in the tangles of grape vines. It is a vivid green and cream colored insect, incapable of flight but with extremely large and powerful jaws, which it is very ready to use. Outside of our own collection very few specimens have been taken of this genus, which occurs at a number of localities in Texas and also in northern Mexico. The jaws of several of the

species are so powerful they are capable of nipping a piece of flesh from one's finger, if you are careless enough in handling the creature to permit it to get its bull-dog grip.

From Clovis, New Mexico, the last of the Staked Plains centers from which we worked, a side trip of several days duration was made into the Pecos Valley of New Mexico, our object being to ascertain to what extent this valley was penetrated by the Chihuahuan or Eastern Desert influence, as found in the El Pasan region of extreme western Texas, an area with which we were very familiar. The indications of this influence were marked, even at Roswell, the most northern of the two sections examined, while about Carlsbad, some distance down stream, the hillsides were well clothed with creosote bush (*Covillea*), cat-claw (*Acacia*), ocotillo (*Fouquieria*) and sotol (*Dasylirion*), all showing the extension of this truly desert element from regions to the southward. The Orthoptera showed as clearly as the plant life the nearness to the Rio Grande region of western Texas, where we had spent much time in the past twenty years. An old friend among the plants of western Texas, the black brush (*Flourensia cernua*), was found near Carlsbad, and search made at once for a most striking genus of grasshopper, which we had discovered some years ago was almost entirely restricted to it as a host plant, finally brought our little acquaintance to light.

From the Pecos Valley a long zig-zag journey was made to the first station of the Colorado section of our trip, a journey which took two nights and a day and a half of nearly continuous travelling, although the actual air-line distance was not more than four hundred and twenty-five miles. A lay-over of part of a day at Pueblo, Colorado, enabled us to do some work on the "bench" near that stricken city. Pueblo was just lifting its head and gathering its strength for the terrific task of rebuilding and rehabilitation after the really terrible floods of June, 1921.

The usual summer crop of Colorado mountain wash-outs had been reported for a very large part of the territory we wished to examine in that state, and as we traveled by night from Pueblo to Salida by train through steady rain it seemed that the reports were justified. Fortunately, however, we were not seriously delayed at any point by rains or washouts, and it was possible for us to carry out all of our tentative plans, in fact to make several additional productive side trips. Salida is in the valley of the Arkansas

River, at an elevation of about 7000 feet. To the west the Saguache Range towers, here forming the Continental Divide, with Mt. Princeton dominating the landscape to the northwest, while the east side of the valley is flanked by the Park Range. From Salida as a base studies were made and collections secured at points on the east side of the Divide to the summit of Monarch Pass, at 11200 feet, and for a distance down on the western side of the range. From the juniper and piñon clad foothills about Salida one passed upwards through forests of pine, gloomy stretches of spruce and fir, with many patches of paler green of the aspen thickets, while at the summit of the Pass the prostrate timber-line pines struggled for a few hundred feet higher on sheltered slopes and then gave up the struggle, leaving the ridges of decomposed granite bare and wind swept. The view to the west from the Pass is tremendous in its scope, and most of the higher mountain peaks of southwestern Colorado can be seen, although some are far distant. To the south towered Mt. Ouray, and to the east sharply cut Mt. Shavano dominated the landscape. At the summit we found one of the great desiderata of the trip, a species of grasshopper which had not been secured since the time of its description, nearly fifty years ago. Here it was in numbers, and it is now possible to study the insect from properly prepared material, instead of shrivelled alcoholic-preserved specimens.

From Salida we crossed the Divide by the famous narrow-gauge railroad over Marshall Pass, at 10856 feet, and then down the valley of the Gunnison River to the town of Gunnison. Gunnison is virtually surrounded by mountains, many with visible patches of snow at the end of August. The West Elk Range to the northwest and the Cochetopa Hills to the south are particularly impressive mountain masses. Gunnison is rather high, about 8000 feet elevation, and as one follows down the river he enters the remarkable Black Canyon of the Gunnison, which, on account of the lack of space for a roadbed, the railroad must leave, by way of a side canyon climb up and over a divide, then run down into the valley of the Uncompahgre. Here with Montrose as a center we examined conditions ranging from the irrigated land of the bottoms to juniper and piñon covered hillsides. The driving of the Gunnison Tunnel, a masterly project of the United States Reclamation Service, has turned the vicinity of Montrose into a thriving agricultural com-

munity, as the abundant water supply of the Gunnison River is carried through a six mile tunnel under a mountain range, and helps the otherwise inadequate water supply of the Uncompahgre River irrigate the fertile and extensive Uncompahgre Valley. To the south of Montrose, and hemming in the valley in that direction, one sees the jagged outlines of the San Juan Range, as saw-toothed as any range of great size in the United States, of far greater charm and variety than the main chain of the Rockies generally seen by the tourist. To see the San Juans one must go off of the

LOOKING NORTH-EAST FROM ST. SOPHIA RIDGE, SAN JUAN MOUNTAINS. ABOVE TELLURIDE, COLORADO. ELEVATION, 13,100 FEET.

main arteries of travel; there is no doubt in our mind but they will feel repaid for the experience. For our San Juan work the mining town of Telluride was our center. Here at 8800 feet the nights are cold, even in early September, as you are virtually at the head of the box canyon of the San Miguel River, the smelter-polluted water of which rolls its gray course over a cobbly bed. In every direction but to the west Telluride is encircled by high mountains, and our work carried us from the vicinity of the town to the summit of St. Sophia Ridge at 13100 feet. Several great and famous gold mines were on our route, the "Smuggler" and "Tom-Boy" particularly, while the "Liberty Bell" was nearby. Above the "Tom-Boy" mine, at 11500 feet, we passed the last of the timber and from there upward

our course was in the Arctic Alpine Zone. Pikas, those queer little cousins of the rabbits, which affect such environments in our western mountains as well as those of northern Asia, bleated from most every slide rock slope, while the large marmots, close relatives of our woodchuck of the East, whistled from lookout points. Those cheery little bird sprites of the high mountains of our West, as well as those of the northern Old World, the leucostictes or rosy finches, made up the bird life of these bleak altitudes, but my greatest disappointment was at not seeing ptarmigan. I have been in ptarmigan country a number of times, but a sight of the bird in life has never been my privilege.

On the summit of St. Sophia Ridge we went through a chilling and dispiriting hail-storm, which numbed one to the bone, but fortunately it passed quickly and our work in the alpine meadows a few hundred feet below the ridge made amends for our stiff fingers. Our work at high altitudes in the San Juans gave us greatly needed data on two strictly alpine species, while the distributional information secured on a number of others is invaluable.

Leaving the high San Juans our activities were transferred to the lower or more desert sections of southwestern Colorado and adjacent New Mexico. At Mancos, near the Mesa Verde National Park, and about Durango, in the Animas Valley, we studied the orthopterous fauna of the juniper and piñon hill-slopes of this section of the state, as well as the yellow pine region of the Animas Valley above Durango, toward Silverton. A side trip to Farmington, New Mexico, in the San Juan River Valley, was of very great interest, as it is in a desert region of about 5500 feet elevation, but one which, when better means of communication are established, will be a great agricultural district, as the valley is wonderfully fertile when irrigated. Water here is not the major problem, thanks to the high mountains to the north in Colorado. Into this region from the southwest, from the country of the Painted Desert of Arizona, has entered a fauna alien to most of New Mexico, and in our own field of activities the evidence of this was very interesting. To the westward down the San Juan stretches seemingly limitless level country with scattered mountains, while sharply cut, like a pinnacle, the distant crag of Shiprock rises—a spire in the desert.

Chama, New Mexico, in the pines at the west foot of the Contin-

ental Divide, and Los Piños just east of the same, were our next points, and from Los Piños, at 9600 feet, the summit of the Cumbres Range, at 11200 feet, was reached. The whole character of the Cumbres region is different from that of the Saguache Range to the north or the San Juans to the northwest. It is a mountain region of more rounded outline, with the forest cover more "spotty." In an alpine meadow at Los Piños we secured a splendid series of a genus of grasshopper unknown before from the entire region of the Rockies. Snow was threatening at Los Piños, and it was quite evident September eleventh was near the end of the working season for us in such elevations in Colorado.

A brief stop made at Alamosa, in the upper Rio Grande Valley of Colorado, brought to light species of the New Mexican section of the valley, here nearly three thousand feet higher than previously known. Another day spent on the plains near Pueblo added some desired information and much needed material of several scarce or local species to our series, and on September sixteenth we reached Philadelphia after a very successful field season. Approximately eight thousand Orthoptera were secured, as well as a number of other insects, while the field notes and observations made represent in scientific value even more than the specimens taken.

OUR SOUTHERN HIGHLAND STREAMS AND THEIR FISH LIFE.

By Henry W. Fowler.

A hasty journey was made by the writer and his brother, Edwin Fowler, in the interests of the Academy during the month of October, 1921, to the larger streams and their tributaries, which traverse our South Atlantic and Gulf States, heading back in the ridges of the Alleghanies and winding their way across the Piedmont Plateau and the Coastal Plain. This is a region proverbially rich in fishes and from which came many rare and little-known species discovered by the earlier American ichthyologists.

We were successful in securing about three thousand specimens representing upwards of fifty species, a number of which are very rare in collections and known only from the meagre descriptions of their discoverers. The richness of the fauna was a constant de-

light to one familiar only with the comparatively limited life of our more northern streams and the ever present possibility of bringing to light some rare and especially desirable specimen kept our enthusiasm at a high pitch.

Crossing the mountains at Bristol, Tennessee, we passed down the valley of the Tennesee River. The country here, as one sees it from the window of a railroad car, is rather monotonous. The grades we meet are not very steep, except in comparatively few sections. In mid-autumn the brown grass was everywhere in evidence, for the season of 1921 was dry in the extreme. The mountains comprising the outeroppings of the Great Smoky Range and finally Lookout Mountain bring us eventually into the tortuous gorges and abrupt slopes of the Cumberland Plateau, at the approach of the big bend of the Tennessee. These places often remind us of our beech-woods in upper Pennsylvania. Great masses of limestone boulders are strewn about and their white color frequently forms pleasing contrasts with the green verdure. When one ventures afoot into the forests the difficulties of travel are more apparent. Most of the trees on the hills are of moderate or small growth, and largely hard wood. Passing further west the valleys widen and finally we wind about on a level plain with only here and there large hills often "hog-backs," in endless profusion. The country soon becomes more level and the hills are left far to the north and the northeast.

About Decatur we stayed for several days and found most interesting conditions. The Tennessee River is here quite a wide and rather shallow stream and we imagine always soiled or muddy. At least several weeks of dry weather had left it in this condition and we found conditions about the same at most every point that we visited. Quantities of mussel shells, many large and quite thick, are carried ashore in the sand brought in by the river dredges. We were able to examine a number of species, some very attractive in form and color. Fish are taken by the river-fishermen, who have only a local market for their catch. At different points along the river we saw their shacks, and the large heavy fyke or set-nets, hanging in the branches of the trees. The fishing season is carried on with greatest success in the winter, when the river is high. Then great numbers of large cats, buffalo-fish, red-horse, river-suckers, grindles, eels, herring, pike-perch, rock-bass, strawberry-

bass, goggle-eyes, dollardees, etc., are caught. Occasionally one sees a large river catfish brought in, and the head of one we saw must have been from a fish weighing at least fifty pounds.

The level country along the river is often full of ponds, sloughs and bayous. These may extend from only a few rods to a mile or so in length, and vary according to their surroundings. In all of them, the water is constantly muddy. One sees usually but little life in these places, except close to shore where the little top-minnows swarm in myriads. Of the smaller ponds, many had dried up and we were able to walk over their sun-baked and cracked surfaces, with here and there traces of fish, mussels or other animals which had perished as the waters receded. In the larger lagoons or lakes, as they are called, the angler goes forth for the large-mouth bass. He uses a small boat fashioned like a narrow shallow river scow, and with a wooden paddle moves to the desired haunts of the bass. These fish are taken of fair and sometimes large size. The artificial minnow, spoon or plug, bristling with a shower of deadly hooks is most in use. A good angler will often cast far ahead to some favorite haunt of a particular fish. The bass usually strikes as soon as the plug reaches the water, or he may wait until further enticed by the little jerks given on the line as it is reeled in. This surely is a good imitation of a swimming frog and is usually rated as the most killing tackle. Often other fishes, especially the blue-gill sunfish, known everywhere as bream, goggle-eye, calico-bass and crappie, are also caught on lines, but with the baited hook. The large and curious spoon-bill sturgeon or paddle-fish, quite a characteristic feature of the deeper channels, is taken in nets. Kingfishers, herons, and cormorants were the usual water-birds of the region, while in the groves and adjacent woodlands we found the wood-pewee, red-bellied woodpecker and blue-jay, besides several brilliant warblers.

The river pond is often interesting in the greatly varying conditions presented. The water, with its more or less dull and muddied monotony, is frequently varied with sudden and pleasing contrasts. Due to the great diversity of light one is often astonished at the rapid change and apparent shift in the scene. If the air should remain perfectly still or without any breeze blowing, the surface of the water presents a solid broad covering well out from the shore line of rich bright green, truly algal green in all its lux-

uriance. In bright sunlight, or often in reflected lights, the tints are most brilliant and rich. Sometimes these so-called algal mats may extend the whole length of the pond. Often times the lagoons or lakes will appear perfectly clear or even with brilliant reflections in their muddy waters on bright days. In the early morning or late evening the effects of light and shadow often add still greater contrasts. Should the wind suddenly ruffle the surface the algal mat disappears as if by magic.

The tributary streams in the Tenessee valley of this section are

PAINT ROCK CREEK, ALABAMA.

interesting on account of the richness of the fish-fauna in their lowland reaches. In Limestone Creek we secured no less than twenty-three species in about an hour. This stream flows through many woodlands or brushy places, and in one locality we found small muddy pools left from the time of high water or floods, completely stocked with quantities of small fish, but it was only after dragging a net across one that we were aware of any life beneath the brown water. About the swamps and woodland were many large magnolias, often with great swollen roots and trunk bases. Here and there were mocking birds, cardinals, small flocks of doves and an occasional red-shouldered hawk.

The most interesting of the Tennessee tributaries was Paint Rock Creek, further up in the foothills. At the village of the same name this stream furnished power for an old and picturesque mill.

Large bales of cotton were brought here, picked in the near-by cotton fields. Cotton and corn appear to be the only crops, with the addition of some cane, in places. The water in the Paint Rock was comparatively clear, and less muddy than in most of the water-courses of the region, or for instance the deep muddy trough of the Flint River. Several miles either way the Paint Rock Creek has high steep banks, mostly covered with tangles of briars and dense vegetation. The water itself was often choked up with snags, roots, rocks, etc., flowing usually over clay bottoms.

CEDAR CREEK, GEORGIA.

About the shallows below the dam we found the only submerged aquatic plants, clusters of *Myriophyllum*, etc. Consequently the only fishes were free-swimmers, though cats and various suckers were said to be abundant.

Passing over into the upper tributaries of the Alabama River basin in upper Georgia, the conditions are more like those of the upper or mountainous regions in which the Tennesse originates. These headwater streams all have a south-westerly course, and flow down through the various valleys south of Lookout Mountain. As typical of the Coosa basin we visited Cedar Creek, below Rome, and followed it through several miles of interesting country. It is a truly beautiful stream, the water of rather bright green color, perfectly clear and pure, and with riffs and little cascades about every span of several hundred yards. The stream is rather rapid,

though stony and shallow in places. The minnows peculiar to this stream are beautiful bright silvery species, and on account of the conspicuous black spot at the base of the tail known locally as spot-tails. Most of the fishes we found were active, though weak little forms, the darters and sculpins being few.

About Atlanta one comes in contact with a number of interesting headwater streams, like those of the Chatahoochee to the north and west, or the watercourses flowing across the Coastal Plain into the Atlantic. Most settlements near the city deposit their sewage in the near-by streams, so that many are now in various stages of pollution and the fishes have largely if not entirely disappeared. In a mill-pond a few miles distant from the city, interesting pond conditions have developed. A patch of the arrow leaf (*Sagittaria*), still with some bloom, was growing in a few places along the shores. Roach, catfish, bream, tadpoles of various species, and great numbers of crawfish, were met with, though all pale or very dull in color.

The headwaters of the Oconee River near Lula comprise chiefly a small brook, cold and spring-fed. This flows through the gently rolling country over bottom-lands composed chiefly of gravel and red clay. It is often difficult to approach, due to thickets and dense areas of bushes and shrubs. Great tracts of pine forest, more or less clear and open, render approach in other sections easy. Running over the pine-needles or along fallen tree-trunks we found a few pine-tree lizards. Along the brooks the only frog seen was the spring-frog. The usual fishes were great numbers of the little red-chub, and a beautiful little darter largely blue-green in color. The streams tributary to the upper waters of the Savannah River basin, like those of Toccoa Creek, closely resembled the Oconee. They traversed more mountainous sections and usually had more rapid rocky tributaries. Often these little streams were of rapid cold water, flowing down over boulders and large rocky ledges with occasional waterfalls. Quantities of fish, all free-swimmers, as horny-heads, red-chubs, etc. were found here.

In the Santee Basin, the upper Saluda River, near Piedmont, South Carolina, is a great muddy trough, with steep banks, mostly well overgrown. The river fishermen here capture quantities of the channel species, as suckers, the so called "white-carp" or carp-suckers, cats, eels, chubs, various sunfish, yellow-perch, etc.,

with set-nets or lines, as few places will permit the operating of hauling-nets. In the small tributary brooks, the smaller and weaker cyprinoids are abundant and often occur in shoals within favorable little estuaries. Though great schools may sometimes be met with in such places they usually consist of but few species, sometimes entirely of one. Above Spartanburg the Pacolet River is a wide, muddied, stream at the mill dam. Following down from the dam are many shallow pools, the banks and portions of the stream choked up with bushes, logs, limbs, snags, gravel bars, etc. Many large rocks are also strewn about. The town has in no way improved the situation with its generous contributions of refuse, old tins, cast off utensils, and other trash.

The Dan River at Danville, Virginia, is obstructed by several concrete dams and spanned by as many long bridges. The dams result in a succession of shallows, and below the cascades the rocks are all worn down. The larger pools contain carp, suckers, cats and sunfish, etc. In two tributaries near the town, the water is of great clarity, and flows over a broad, gravelly or sandy bottom. Usually one meets with but few snags or roots here though everywhere are shoals or bars. The fish in these streams are exceedingly abundant, frequenting mostly the little eddies or backwater pools, usually about the bends. A great variety of brilliant silver-fins, red-fins, painted-minnows, etc., were found, sometimes in great schools.

The wild mountainous regions of the southern Alleghanies will always have a charm, all their own, to the naturalist or rambler. It was our fortunate experience, to see this country during the finest season of the year, October, when it was at its best. The long hot summer having passed there was just enough tone or snap to the air to render it exhilarating, if not actually stimulating. This, and the fact that the sun shone at least part of each day if not all day long, afforded us splendid weather afield. The great watercourses and their hosts of tributary streams, with all their wonderful array of fish-life, the richest in all the fresh-waters of the United States, will long remain to a large extent a terra incognita to the ichthyologist. He will require untiring energy and exertion to even partially explore this vast field. We therefore feel that our own modest effort will be crowned with success can we but induce others to carry forward where we have but momentarily paused.

THE SIERRA LA SAL, UTAH.

BY HENRY SKINNER, M.D., SC. D.

Some years ago, while on a collecting trip in the Wasatch mountains of Utah, I was told of another range of high mountains in the southeastern part of the State. They were said to have an abundant and rich vegetation and to be well watered by streams

EIGHT HOURS TO GO TWENTY MILES.

and some lakes. A locality of that description should have an interesting insect fauna and, so far as I knew, it had never been visited by an Entomologist, and I determined to go there some day if possible.

In the spring of 1920, Mr. R. A. Leussler, a well known Lepidopterist, of Omaha, Nebraska, informed me he wished to go on a collecting trip and we planned to go to the Sierra La Sal. The conditions one may encounter are an unknown quantity and we did not know whether we would need guides, horses, or a camping outfit. Usually it is wise to get as much information as possible in advance but to a certain extent we decided to be governed by

conditions as we found them. We did however, receive information about the country from the postmaster at Moab, the agent of the Denver and Rio Grande Western Railway at Thompson, and the La Sal Live Stock Company, at La Sal. I found Mr. Leussler at his home in Omaha, ready and enthusiastic. Our first stop was made at Glenwood Springs, Garfield County, in western Colorado, which is the type locality of some interesting and rare butterflies. Collections were made in the nearby mountains on July 11th, 12th,

THE WILSON MESA.

and 13th. This was an enjoyable break in the journey on our way to Thompson, Utah, where we arrived about noon on the 14th. This is a small railway place and as we approached it we could see the Sierra La Sal about sixty-three miles distant.

The road from Thompson is largely two deep ruts in the sand of a typical desert country and the distance to Moab is 38 miles. An automobile stage line runs between the two places. The journey over the desert plain was not devoid of interest but the scenery improved as the canyon was reached that leads to Moab and the Grand river. The sandy areas are not entirely devoid of

vegetation and sage-brush and shad-scale are scattered about. Moab is a small oasis and has a population of about 600 and is situated on a creek that runs into the Grand river. Its altitude is 4,000 feet and the valley is surrounded by high cliffs that remind one of the Grand Canyon of the Colorado. The natural flora is of a desert character but many fruit and other trees, as well as a variety of crops, are raised by means of irrigation. Along the river may be seen a number of kinds of trees, including *Salix*, *Rhus*,

THE SANDSTONE FLATS.

Populus, *Celtis*, and *Rhamnus*. The people we met in Moab were very pleasant and gave us all the information in their power.

The postmaster, Mr. Shafer, has a married daughter living in the mountains and through him we arranged to go to the ranch of Mr. and Mrs. John W. Sullivan and make it our headquarters during our stay. Through the kind efforts of Mr. H. W. Balsley, a Moab banker, we secured a team to take us to the Wilson Mesa where the Sullivans lived. Some idea of the going from Thompson to Moab may be gleaned from the fact that it took nearly three hours to make the 38 miles in an automobile and the journey to

follow promised to be much worse. We were warned that the so-called sand flats had many disagreeable features and that it would take about eight hours to reach the Wilson Mesa and the distance was only twenty miles. The road from the town runs along Pass creek and a short stop was made to gather some ripe apricots that helped to quench thirst later on. The sand-flats and sand-hills were soon reached and made me think of a character in one of Captain Marryat's stories, who said he had visited regions where

HUNDREDS OF ACRES OF SANDSTONE.

beef-steaks could be fried on the rocks and this was the first time I had thought such a thing might be possible. As we went on our way there was a marked difference in the character of the country and the change from the desert valley to the sand-flats was full of interest; and then came the sandstone hills and in the distance was the snow glistening near the tops of the peaks.

There are immense sandstone masses, often jagged and castle-like on top and in other places many acres of stone nearly level. These places have small plants where there is a little depression that will hold earth or moisture. The foot-hills contain many low

shrubs, *Amelancher utahensis*, *Cerocarpus montanus*, *Coleogyne*, *Petradoria*, *Yucca*, *Nuttallia*, *Fendlera*, *Ephedra*, *Gutierrezia*, *Cowania*, *Quercus*, and other species and genera abound. Higher up are the cedars, pinyons, aspens and spruces.

Some of the lower levels were very bare and stony and to reach the sand-stone flats we went through some narrow, rocky passes that appeared almost impossible. Hundreds of acres of sandstone were in view and in places it assumed fantastic forms, like human

DOMES AND CASTLES WERE NOT UNCOMMON.
A REMARKABLE BALANCED ROCK (LEFT OF DOME).

beings turned to stone and domes and castles were not uncommon.

A remarkable balanced rock was seen some distance away, that must have weighed many tons. It was in the form of an inverted cone and the point of the cone was so attenuated as to look needle-like. It was by far the most interesting balanced rock I had ever seen. There was a dearth of animal life but a close examination would probably have disclosed more. A white butterfly (*Pieris*), a moth-like butterfly (*Megathymus*), a grasshopper, and a hawk, were the only creatures noticed, with the exception of an alert animal on

the hot rocks, a lizard about a foot in length, of great beauty, being a brilliant metallic green. Three or four were seen but we had no way of capturing them.

There was a cold spring about half way to the mesa and we stopped there for lunch and the menu was the usual one on such occasions,—coffee and sandwiches. The spring-water for dessert in the desert was a real treat. From here the way was through the cedar and pinyon until we reached the Wilson Mesa, covered

DEEP CANYONS THAT WERE NOT SEEN UNTIL REACHED.

partly by chapparals and scrub-oak, except where cleared for the cultivation of alfalfa.

We arrived at the Sullivan Ranch at 7:30 P. M., had a wholesome dinner and retired for the night. This place is at an elevation of about 6200 ft., and here the days are warm and full of sunshine and the nights quite cool. Twelve days were spent in the mountains collecting. Mr. Leussler confined his attention to the Lepidoptera, while the other member of the party took in all the orders of insects.

The sombre butterfly, *Satyrus paulus*, was abundant in the scrub-oak and not infrequently alighted on the bark. It is a wary creat-

ure, with its jerky flight, but we manged to capture a nice series. A little higher up, in a draw or small canyon, we found *Thecla crysalus*, a butterfly of an unusual shade of blue. Grasshoppers of a number of species were in evidence, but other insects were scarce in comparison with the much richer Wasatch mountains. From morning until sundown we explored within a radius of some miles, as far as we could cover on foot in a day, but the high mountains were still beyond and lured us on. After going up rises of hundreds of feet we found other hills still beyond and deep canyons that were not seen until their edges were reached. In the distance impenetrable oak and aspen thickets looked like well-cropped lawns. Peaks that looked as though one might walk to them in a few hours were days away and had to be reached by circuitous routes by means of saddle and pack horses. In a beautiful little valley at 7000 feet, almost hidden by aspen and fed by a splendid spring, we found the true *Argynnis chitone*, one of the silver-spotted butterflies. About a thousand feet higher a species of moth (*Pseudohazis*) was flying; it has a flight much like a *Papilio*. On the 23rd of July, after due preparation, we started on our trip to the higher altitudes. Mr. and Mrs. Sullivan also concluded to take a vacation, as they were fond of camping and outings in the mountains.

Four good saddle-horses and a pack-animal were a part of our necessary equipment. The weather was ideal and the mountain scenery very beautiful.

The La Sal is a National Forest Reservation and our objective point was the Warner Ranger Station at an elevation of 9,490 feet. From this point we could see the top of one of the big peaks rising some thousands of feet above us. Here were some interesting stands of forest trees and in the glades we again found the silvered butterflies and other species not taken at lower levels. A night and part of a day were spent here and then we went still higher to the saw-mill, where we wished to collect, at 10,000 feet altitude. From this place we had an excellent view of Mt. Peale which rises to 13,089 feet. Engelmann spruce grow to a huge size at this elevation and we saw some specimens that may have been three hundred years old. The tops of the mountains are bare and covered with talus, but plants such as *Polemonium confertum*, *Erigeron trifidus*, *Arenaria obtusifolia*, and *Claytonia megarrhiza* grow at

high altitudes. At the saw-mill were many beautiful clumps of flowering plants, among them a columbine which had very large flowers, and these clumps sometimes covered several hundred square feet. Many acres were made yellow by the blooms of *Dugaldia hoopesi*. A tall larkspur was in bloom and the flowers were lovely but the plant is very poisonous to cattle and we were told that a number had been killed by eating it. The forest here

THE SIERRA LA SAL IN THE DISTANCE.

is very attractive and extends upward to an altitude of somewhat over 11,000 feet.

Not having any other place available, we slept on the carpet of humus in the virgin forest. It was cold at night, 45° F., and the mosquitoes were numerous and hungry. By using a butterfly net, over a cap, and fastened above the shoulders, sleep was obtainable. The greater part of the next day was spent in collecting at this high altitude, but nothing new or very rare was secured. The return to the mesa was made by another route and it took seven hours to go thirteen miles. Some time after we left, a terrific hail and rain storm began in the peaks and their tops were soon white, and then

the floods began and came pouring down the arroyos, and at one place we crossed an arroyo with great difficulty. A little later while the others of the party were ahead, having safely crossed one of these danger places I heard the flood coming. I was leading my horse at the time and rushed forward, managing to get through the first rush of water with a second or two to spare. The water was the color of chocolate, loaded with small stones and other debris. A moment too late would have meant being drowned or marooned until the mad flood subsided. I was told that several persons had lost their lives by arroyo floods in these mountains. July 28th. we left for Moab and Thompson and found the temperature 96° in the shade; and the train we intended to take for Salt Lake City was seven hours late. The canyons around the City of the Saints are entomologically rich, far more so than in the Sierra La Sal. At the former place about 115 species of butterflies have been recorded. Returning we spent a few days at the higher points on the Union Pacific Railway, Evanston, and Laramie in Wyoming. We enjoyed our stay in the Sierra La Sal. The mountains are of interest to the geologist and mineralogist as well as the botanist and zoologist. The highest mountains are Mt. Peale (13,089 ft.), Mt. Waas (12,586), Mt. Tomasaki (12,271), and Tukuhnikikivatz (12,004 ft.) This last name is of Navajo origin. Carnotite, the ore of radium is mined, as well as gold and other metals and minerals.

In the summer of 1911, P. A. Rydberg collected botanical specimens in the Sierra La Sal and I know of no other naturalist who has visited them.[1]

[1] See: Journal New York Botanical Garden, XII: 143. 1911.

ADMINISTRATION OF THE MUSEUM

BOARD OF CURATORS.

WITMER STONE, *Executive Curator.* HENRY A. PILSBRY, *Secretary.*
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Vertebrate Zoology.

WITMER STONE, *Special Curator.*
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HENRY W. FOWLER, *Assistant Curator, Fishes and Reptiles.*

Mollusca and other Marine Invertebrates.

HENRY A. PILSBRY, *Special Curator.*
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Insects.

HENRY SKINNER, *Special Curator.*
JAMES A. G. REHN, *Assistant Curator.*
E. T. CRESSON, JR., *Assistant Curator.*
MORGAN HEBARD, *Research Associate.*

Plants.

FRANCIS W. PENNELL, *Special Curator.*
BAYARD LONG, *Research Associate.*

Minerals and Rocks.

FRANK J. KEELEY, *Curator of the William S. Vaux Collections.*
SAMUEL G. GORDON, *Assistant Curator, in charge of the General Collection.*

Archeology.

MISS H. NEWELL WARDLE, *Assistant Curator, in charge.*

Ludwick Department of Public Instruction.

HAROLD T. GREENE, *in charge.*

Taxidermist.

DAVID MCCADDEN.

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*Deceased April 12, 1922.

Report of the Curators.

The Museum halls have been open free to the public as usual throughout the year with a constantly increasing attendance especially on Sundays and lecture days.

Notable among the specimens received for exhibition have been a series of beautifully mounted heads of African game animals deposited by Mrs. B. C. Madeira, and several others presented by Mr. Edward Browning. Also a fine specimen of the rare giant spider-crab of Japan presented in the name of Edward Russell Jones by Mrs. Edward Russell Jones.

At the very close of the year it was possible to secure the services of Mr. Harold T. Green to take charge of the Ludwick department of Public Instruction, the objects of which were outlined in last year's report, and plans are already under way for increasing the educational value of the museum.

Two handsome exhibition cases have been provided through the generosity of a member for the further display of specimens in the Archeological Department.

Early in the year the Academy suffered a severe loss in the death of Stewardson Brown, for twenty years in charge of the Herbarium. Largely owing to his faithful care the historic collections contained in this department of the museum are now in an excellent state of preservation and readily available for study. On October 1, Dr. Francis W. Pennell was appointed Special Curator of Plants to fill Mr. Brown's place, and Mr. John M. Fogg Jr., was appointed a student on the Jessup Fund to act as an assistant in this department.

In the department of Vertebrate Zoology Mr. Wharton Huber was appointed an Assistant Curator in charge of birds and mammals. Owing to the constantly increasing duties of the Executive Curatorship, Dr. Stone has been unable during the past several years to give these collections the care and attention that they required, and the appointment of Mr. Huber has resulted in bringing them into excellent order.

The usual amount of local field-work has been accomplished by members of the scientific staff and several more extended expeditions have been successfully carried through.

Mr. Samuel G. Gordon, in charge of the mineralogical collections, was given leave of absence from May 28 to November 15 for a trip to South America in the interests primarily of the William S. Vaux Collections, the remainder of the support being provided directly by Mr. Gordon, and from the disposal of duplicate specimens which he obtained. He traversed the Andes of Ecuador, Peru, Bolivia, and Chili, visiting many of the more important mines and securing a large amount of material, both minerals and rocks.

Through the generosity of Mr. Morgan Hebard it was possible for Mr. Rehn to accompany him on a trip of six weeks through portions of Texas, New Mexico, Kansas, and Colorado, on which a large collection of insects, mainly Orthoptera, was obtained.

Dr. Pilsbry spent part of the summer in studying the molluscan fauna of Lake Champlain and the adjoining portions of the Adirondacks, and secured several thousand specimens.

Mr. H. W. Fowler visited during the month of October the principal streams flowing from the southern Alleghanies, and secured some three thousand specimens of the freshwater fishes inhabiting the region; while Dr. Stone made a short trip into the mountains of eastern Kentucky obtaining a series of the early spring plants and a collection of the land mollusks, besides much information regarding the distribution of life in this little-known region.

Mr. Clarence B. Moore continued during the winter his archeological exploration on the west coast of Florida and the Florida Keys.

Improvements in the museum building during the year include the building of a rest room for women, completing the improvements to the heating plant, rewiring the electrical connections in the lecture hall and library, the installation of a moving picture machine and erection of a closed booth for all of the projecting apparatus. The last improvement materially increased the seating capacity of the lecture hall.

A number of societies, mostly national in character, have held their annual meetings in the building during the year. These included the American Ornithologists' Union, the American Society of Ichthyologists and Herpetologists, the American Association of

Ophthalmologists and Oto-Laryngologists. Local societies have also held their meetings at the Academy, including the Garden Clubs of Philadelphia, the Delaware Valley Ornithological Club, the Philadelphia Botanical Club, and the Philadelphia Mineralogical Club.

Details of work in the several departments and accessions for the year follow:

MAMMALS

Many valuable specimens have been received from the Zoological Society of Philadelphia which have been prepared either for study or exhibition.

The study collection has been carefully examined and poisoned preparatory to a thorough rearrangement.

BIRDS

A valuable collection of skins from the interior of Bolivia containing many species new to the Academy's collection was purchased from Mr. José Steinbach. A number of important specimens were presented by the Zoological Society including a kagu, a bird hitherto unrepresented in the collection. Many noteworthy local specimens were also received from various sources. The most notable accession, however, was the series of South American water-birds generously given by Dr. L. C. Sanford, being duplicates from the collection made for him by Rollo H. Beck, the main portion of which is in the American Museum of Natural History, New York. The collections have been extensively studied during the year by visiting ornithologists. The meeting of the American Ornithologists' Union brought to the Academy most of the leading ornithologists of the United States and Canada, who made free use of the specimens in their studies. Mr. H. Kirke Swann, the British ornithologist, also visited the Academy on this occasion.

During the year Mr. Huber has catalogued and labelled all of the accumulated material and distributed it through the collection. He has completed the labelling of the various cases, which greatly facilitates consultation. He also relaxed and restuffed many poorly made skins among the recent accessions.

REPTILES AND FISHES

Mr. Henry W. Fowler who has continued in care of the collections reports that he has examined during the year the entire series of reptiles and batrachians and about a third of the fishes, and has replenished the alcohol wherever necessary, so that this part of the collection is now in excellent condition.

He has identified all of the material received during the year and catalogued 73 reptiles and amphibians and 228 fishes. A paper has been prepared for publication on the sticklebacks, sea-horses and allied fishes in the Academy's collection.

Further notable additions are included in a collection of reptiles and fishes from Nicaragua from Dr. Theodore Bouchelle; and a collection of Formosan fishes from Dr. Masamitsu Oshima.

MOLLUSKS

Dr. Henry A. Pilsbry, Special Curator of Mollusks, reports that gifts of mollusks have been received from 79 persons, the more interesting accessions being a series of Venezuelan shells from Dr. H. Burrington Baker, and Madeiran shells, partly received alive, from Prof. T. D. A. Cockerell. Messrs. Ferriss, Clarke, Malone, Dr. S. S. Berry, and others, have continued to add to our North American series. The Special Curator procured some thousands of specimens from Lake Champlain and the adjacent Adirondacks.

Work on the monograph of Pupillidae has progressed to the completion of the subfamily Pupillinae.

Throughout the year Dr. C. Montague Cooke, of the Bishop Museum, Honolulu, has prosecuted his studies on the anatomy of Hawaiian land snails in the laboratory of the department. Dr. H. Burrington Baker, of the zoological staff of the University of Pennsylvania, has worked up collections made by him in Mexico and Venezuela, finding time also for comparative studies on the dentition of Helicinidae and Neritidae, the results of which have been submitted to the Academy for publication.

Mr. Vanatta has rendered efficient service in taking care of new material, and in a re-arrangement of the collection of fresh water mussels, which had outgrown the space formerly allotted.

Specimens have been loaned during the year to 12 naturalists in other institutions.

INSECTS

Dr. Henry Skinner, Special Curator of Insects, reports that 5526 specimens have been received during the year. The care and preservation of the collections has occupied most of his time, but a number of specimens have been mounted and incorporated. Research work has been carried on and a number of papers published.

During the year Mr. Rehn and Mr. Hebard have continued the rearrangement of the exotic series of Dermaptera and Orthoptera, the representation in certain groups being greatly augmented by the addition of recently studied collections.

Mr. Rehn completed his study of the Blattidae of the Transvaal Museum collection, and progress was made upon a comprehensive study of the West Indian Blattidae, and another of the African Blattidae of the Paris Museum. The Blattidae of the Indian Museum collection and the Acrididae of the Zoological Museum at Buitenzorg, Java, have been received for study by Mr. Rehn. From all of these, as well as numerous other invaluable collections previously received, the Academy will secure fully representative series for his services. Purely clerical work of the Recording Secretary's office has greatly restricted the time available for his studies. This it is hoped may be remedied in the not distant future by securing suitable clerical help for secretarial routine, so that the Academy may have the credit and returns accruing from the study of noteworthy collections submitted for examination to a member of its staff.

Mr. Hebard has completed a comprehensive study of the Dermaptera and Orthoptera of the Hawaiian Islands, to be published by the Bernice Pauahi Bishop Museum; also a study of the Dermaptera in the collection of the Agriculture Institute at Pusa, India. A report on the previously unstudied Mexican Blattidae in the collections here was also prepared by him, and he is at present engaged with the examination and description of extensive collections of Malayan and Papuan Tettigoniidae. He has also received for study the collection of Blattidae of the Pusa Agricultural Institute, all of the Hawaiian Dermaptera and Orthoptera of the Bishop Museum collections, as well as various smaller representations. He has also secured by purchase and otherwise important series of

Orthoptera from South America, Katanga in the Belgian Congo, British India, and the Phillippines, all of which will greatly increase our collections when studied.

PLANTS

Owing to the illness and death, on March 14, 1921, of Mr. Stewardson Brown, for twenty years Curator of the Herbarium, the department remained for most of the year without an acting head, though the services of Mr. Glenn were secured in cataloguing and distributing accumulated material. On October 1, 1921, Dr. Francis W. Pennell, formerly Associate Curator of the New York Botanical Garden, assumed charge, with Mr. John M. Fogg, Jr., as an aid.

Little change has been possible, so far, in the housing of specimens. The rearrangement of the herbarium is progressing as rapidly as facilities permit, and a further step toward making available for rapid reference will be the arranging of the specimens of each North American species in a definite sequence of countries and states. The North American specimens are now grouped in distinct covers for each species thus making the herbarium a systematic index of plants; the new arrangement of sheets will make it also accessible to students of limited geographic areas.

The new Curator has had little time for research but has given final preparation to a report on the Scrophulariaceae of Cuba. He has in partial completion other studies of the plants of this interesting family. A large number of specimens of Scrophulariaceae, from the Central Rocky Mountain States, and from Colombia, were brought on from New York for further study.

Mr. Bayard Long has continued his supervision of the local Herbarium. He has answered many queries, determined a large number of specimens for various collectors, and has done critical study on certain genera. During the spring he continued the naming of Yukon plants, collected by Mr. Adolph Muller and left in part identified by Mr. Brown. During the summer he was again a member of the Gray Herbarium Expedition for the botanical exploration of Nova Scotia.

MINERALS

Mr. Samuel G. Gordon who has had charge of the Mineralogical collections during the year reports that his time during the early part of the year was occupied with the investigation of Penn-

sylvania minerals and rocks and the preparation of a number of new accessions. Among the more notable of these was a collection of zoolites from the Perkiomenville quarry, in Montgomery County, presented by Messrs. Hilbiber and Tallis.

From May 28 to November 15 Mr. Gordon was absent on the expedition to South America elsewhere described.

During the year a Goldschmidt two-circle goniometer was purchased for the laboratory of the department.

ARCHEOLOGY

Miss H. Newell Wardle, in charge of this department, reports that another portion of the Gottschall collection, including costumes and weapons of the Apache and Kiowa and a series of Navajo blankets, has been placed on exhibition, while progress has been made in cataloguing other portions of this collection.

Mr. Clarence B. Moore's winter expedition to Florida resulted mainly in securing duplicates of shell artifacts which have been used in exchange with other museums for valuable collections from the Cliff-dwellings, the ancient Pueblos, and from Mexico, thus greatly enriching the department.

REPORT OF THE CURATOR OF THE WILLIAM S. VAUX COLLECTIONS.

During past year, the William S. Vaux Collections have been enriched by numerous accessions, the most important of which were the minerals collected by Mr. Samuel G. Gordon in Peru, Bolivia, and Chile, numbering about two-hundred-and-fifty specimens and including magnificent suites of brilliant, highly modified tetrahedrite, bournonite, enargite, wolframite, translucent cassiterite, bismuth nodules, as well as many rare species, some of which are new to the collection.

The following were gifts to the collection: Rutile, Rowlandsville, Philadelphia, Samuel G. Gordon; Quartz and beryl, Boothwyn, Pa., Thomas Harvey; epidesmine and natrolite, Perkiomenville, Pa., Frederick Hilbiber and John Tallis; gold pseudo. calaverite, Cripple Creek, Col., and sodalite, Ice River, British Columbia, George Vaux, Jr.

Forty-five specimens were purchased of which the following are noteworthy: a twin crystal of quartz, 14 inches in diameter, from Japan; unusually large crystals of native lead from Sweden; rhodochrosite from Franklin, N. J., transparent yellow orthoclase crystal and cut gem from Madagascar; and two individuals of the Richardton, North Dakota, aerolite.

Respectfully submitted

F. J. KEELEY,

Curator.

ADDITIONS TO THE MUSEUM.

1921.

MAMMALS

MISS M. C. BOOTH. Skin of Short-tailed Shrew (*Blarina brevicauda*).

BRITISH MUSEUM, in exchange. Skins and skulls of *Caviella australis*, *Ctenomys luteolus*, and *Phyllotis ricardulus*.

HENRY W. FOWLER. Skin and skull of rabbit.

HEBARD-ACADEMY EXPEDITION 1919. Skin and skull of weasel (*Mustela streatori leptus*), Santa Fè Range, New Mexico.

S. N. RHOADS. Skin and skull of rabbit.

ZOOLOGICAL SOCIETY OF PHILADELPHIA. Skins and skulls: Bandicoot (*Peragale sp.*); Brazilian Tapir (*Tapirus terrestris*); South African Eland (*Taurotragus canna*); Cape Giraffe (*Giraffa capensis*). Skin of young Hippopotamus (*Hippopotamus amphibius*); Nail-tailed Wallaby (*Onychogale unguifera*); Bernard's Kangaroo.

BIRDS

DR. W. L. ABBOTT. Skins of San Domingo Savanna Sparrow ((*Ammodramus savannarum intricatus*).

W. L. BAILY. Skin of Saw-whet Owl (*Cryptoglaux acadica*).

O. H. BROWN. Skin of Cooper's Hawk (*Accipiter cooperi*).

WILLIAM BURWELL. Male Florida Gallinule (*Gallinula galeata*).

E. REHN CASEY. Skin of Barred Owl (*Strix varia*).

HENRY W. FOWLER. Skin of Double-crested Cormorant (*Phalacrocorax auritus auritus*).

MISS ESTHER HEACOCK. Skin of Screech Owl (*Otus asio*).

LEVI D. HOPPER. Four-legged chicken, Philadelphia.

WHARTON HUBER. Two bird skins.

J. G. KINLEY. Skin of Loon (*Gavia immer*).

D. MCCADDEN. Eight skins of Sora (*Porzana carolina*).

F. GUY MYERS. Two skins of Marsh Hawk (*Circus hudsonius*).

C. H. NEWCOMB. Two skins of Golden-eye Duck (*Clangula clangula americana*).

S. N. RHOADS. Skin of Starling (*Sturnus vulgaris*). Eighteen skins from Florida.

BOYD P. ROTHROCK. Skin of Eider Duck (*Somateria spectabilis*).

SAMUEL SCOVILLE, JR. Robin's nest with two eggs.

DR. HENRY SKINNER. Skin of Starling. Eggs and skin of Lady Amherst's Pheasant.

DR. WITMER STONE. Ten bird skins from New Jersey.

DR. SPENCER TROTTER. Skin of Hairy Woodpecker (*Dryobates villosus*) and Cooper's Hawk (*Accipiter cooperi*).

U. S. CUSTOMS OFFICE, PHILADELPHIA. Skin of Bird of Paradise (*Paradisea minor*) and 21 other skins.

DR. HENRY R. WHARTON. Skin of Red-throated Loon (*Gavia stellata*).

ZOOLOGICAL SOCIETY OF PHILADELPHIA. Female skin of Paradise Bird (*Paradisea raggiana*) and skin, with body in alcohol of Kagu, *Rhinochetus jubatus*.

AMPHIBIANS AND REPTILES

DR. THEODORE BOUCHELLE. Two collections of serpents from Nicaragua

J. N. CHRISTEE. Boomslang (*Dipsadophis typus*).

J. B. CLARK. Worm Snake from Clearwater, Fla.

MORGAN HEBARD. Collection from Michigan, Georgia and Florida.

HEBARD-ACADEMY EXPEDITION 1921. Jar of reptiles from Arizona and Texas.

W. C. HENNEBERGER. Fossil Gavial remains, Debeque, Col.

BAYARD LONG. Collection from Nova Scotia.

DR. HENRY A. PILSBRY. Two Rattlesnakes (*Crotalus horridus*) and salamander (*Desmognathus fusca*).

G. W. SULLIVAN. Young two-headed Water Snake (*Natrix sipedon*), Maryland.

FISHES

R. M. ABBOTT. Two fishes from oyster-shells, Rhodes River, Md.

DR. THEODORE BOUCHELLE. Collection of fresh-water fishes from Nicaragua.

HENRY S. DRINKER. Jaws of Great White Shark (*Carcharodon carcharias*) taken in 1920 at Beach Haven, N. J.

HENRY W. FOWLER. Several jars of fishes from Delaware, Pennsylvania, New Jersey.

FOWLER-ACADEMY EXPEDITION 1921. Sixteen jars of fishes, Alabama, Georgia, South Carolina, and Virginia.

G. W. GOUDY. Jar of fishes from Indian Lake, N. Y.

W. C. HENNEBERGER. Fossil fish remains, Debeque, Col.

HOWARD R. HILL. Jar of fishes, Pensacola, Fla.

WHARTON HUBER. Seven jars of fishes, Corson's Inlet, N. J.

J. G. MALONE. Egg-case of Big Skate of California (*Raja binoculata*), obtained at Newport, Oregon.

DR. MASAMITSU OSHIMA. Collection of fresh-water fishes from Formosa.

R. P. SCHRIVER, JR. Porcupine fish (*Diodon hystrix*), N. J.

CAPTAIN CHARLES SILVESTER. Six jars of Samoan fishes.

UNIVERSITY OF MICHIGAN, in exchange. Jar of lampreys and lancelet.

RECENT MOLLUSCA

DR. W. L. ABBOTT. *Pleurodonte undulata* Fér. from near Port au Prince, Hayti.

W. O. ABBOTT. *Tivela abaconis* Dall from Florida.

A. REGINALD ALLEN. Twelve trays of shells from New Hampshire and Pennsylvania.

AMERICAN MUSEUM OF NATURAL HISTORY. Land shells from Africa.

E. ASHBY. *Acanthochiton coxi* Pils. from Tasmania.

F. C. BAKER. Two species of *Lymnaea* from Wisconsin and Minnesota.

H. B. BAKER. One hundred and seventy-nine trays of shells from Colorado and Venezuela.

MISS M. G. BECKWITH. Three species of Hawaiian marine shells.

MISS L. G. BEEKMAN. Five species of marine shells from Ocean City, New Jersey.

DR. J. BEQUAERT. *Limicolaria saturata* Sm. from Mt. Ruwenzori, Africa.

S. S. BERRY. Paratypes of *Polita gabrielina* Ber. from California.

BERNICE PAUAHI BISHOP MUSEUM. Seven trays of Hawaiian land shells.

DR. S. C. BISHOP. Three trays of fresh water shells from New York.

DR. J. F. BRANSFORD. Two species of *Nerita* from Nicaragua.

LOUIS H. BREGY. *Oreohelix strigosa depressa* Ckll. from Zion National Park, Utah.

THE BRITISH MUSEUM. *Gastrocopta mooreana* Sm. from Roebuck Bay, West Australia.

W. A. BRYAN. One hundred and twenty-five trays of Hawaiian marine shells.

H. C. BURNUP. One *Ennea* from South Africa.

CANTON CHRISTIAN COLLEGE. Fourteen species of shells from China.

GEO. H. CHADWICK. *Nerita ornata* Sby. from the Canal Zone.

GEO. H. CLAPP. Eight trays of land shells from Alabama, Florida and Canada.

JAMES B. CLARK. Three hundred and eighty-six trays of shells from Cuba and eastern United States.

T. D. A. COCKERELL. Sixty-three trays of land shells from the Madeira Islands.

MISS EMILY COLLINS. *Cypraea erosa* L.

THE COMMERCIAL MUSEUM. Two marine shells from Barbados Isand.

DR. C. M. COOKE, JR. Four species of land shells from Arizona and California.

SHELLEY G. CRUMP. Seven trays of fresh water shells from New York.

DELOS E. CULVER. Three marine shells from the craw of a black duck.

A. W. FAHRENBRUCK. Four species of shells from Ohio and Canada.

SMITH L. FORMAN. Two species of *Nerita* from Gilberts Bar, Florida.

H. W. FOWLER. Twenty-five species of land and fresh water shells from Alabama and Pennsylvania.

L. S. FRIERSON. Type of *Amblema t. pentagonoides* Fr. from Lake Charles, Louisiana.

J. AND A. GOUVEIA. Six Hawaiian land shells.

DR. I. MINIS HAYS. Twenty-six species of shells.

MORGAN HEBARD. Ten species of marine shells.

J. B. HENDERSON. Two West Indian land shells.

JUNIUS HENDERSON. Twelve trays of land shells from Colorado and Wyoming.

H. C. HIGGINS. Three species of *Partula*.

HOWARD HILL. *Lolliguncul us brevis* Bl. from near Pensacola, Florida.

WHARTON HUBER. Two species of shells from the crops of birds.

FRANCIS JAMES. *Achatinella bulimoides* Sw.

F. J. KEELEY. *Teleoteuthis caribbaea* (Lesr.) from Hawks Park, Florida.

ANNA KEYS. *Conus consors* Sby.

PHILIP LAURENT. Four trays of shells.

BAYARD LONG. Eleven trays of land shells from New Jersey and Pennsylvania.

J. G. MALONE. Seventy-three trays of Pacific shells.

D. P. MANNIX. Three species of shells.

C. T. MANT. Nineteen trays of Hawaiian marine shells.

E. S. MARKS. Fifteen trays of shells from Eastern United States.

D. N. MCCADDEN. *Polygyra albolabris* Say from Wynnewood, Pennsylvania.

DR. H. B. MEREDITH. Two trays of shells from New Jersey and Pennsylvania.

REV. H. E. MEYER. Five species of exotic shells.

J. B. MOCKRIDGE. Five species of Canadian land shells.

CLARENCE B. MOORE. Six trays of shells from Florida.

MISS. EMMELINE MOORE. Eight trays of fresh water shells from New York.

WINTHROP M. MUNRO. Two species of land shells from Texas.

MRS. I. S. OLDROYD. Two marine shells from California.

C. R. ORCUTT. Six Californian marine shells.

LT. COL. A. J. PEILE. Nineteen trays of land shells from India and England.

DR. H. A. PILSBRY. Five hundred and thirty-four trays of shells from the Hawaiian Islands and New York.

PURCHASED. One hundred and eighty trays of shells.

JOSEPH ROSENFELT. One pearl from *Ostrea elongata* Sol.

A. E. SALISBURY. *Succinea putris* L. from near Iver, England.

MISS F. A. SHORTRIDGE. *Murex saxatilis* Lam. from China.

C. T. SIMPSON. Thirteen trays of *Liguus* from Florida.

W. J. SINCLAIR. *Succinea grosvenori* Lea from the Loess at Cedar Pass, South Dakota.

H. E. SNYDER. Two Japanese marine shells.

IRWIN SPALDING. *Gastrocopta servilis* Gld. from Honolulu, Oahu Id., Territory of Hawaii.

DR. WITMER STONE. Forty-two trays of shells from Kentucky and New Jersey.

MISS MARION J. TAYNTOR. Two marine shells.

D. THAANUM. Thirteen trays of shells from Japan and the Territory of Hawaii.

L. A. THURSTON. Three species of land shells from Florida.

J. R. L. TOMLIN. Twenty trays of Pupillidae from the Madeira Islands.

L. VAN HYNING. *Marginella succinea* Conr. from Boca Ceiga Bay, Florida.

DR. BRYANT WALKER. Seven South American land shells.

MISS H. N. WARDLE. Twelve species of shells from Ocean City, New Jersey.

H. WARFORD. Three species of land shells from Pennsylvania.

MISS HELEN WINCHESTER. *Polygyra tridentata* Say from Revis Falls, Pennsylvania.

H. P. WOODWARD. Seven fresh water shells from New York.

D. H. WRIGHT. *Littorina littorea* L. from Newport, Rhode Island.

INSECTS

ACADEMY-AMERICAN MUSEUM EXPEDITION, 1916. Twenty-eight Orthoptera, Southern Arizona.

C. P. ALEXANDER. Forty-eight Tipulidae, South America.

A. R. ALLEN. Male of *Pelecinus polyturator*, Maine.

F. E. BLAISDELL. *Eleodes fuchsi* (paratype), California.

ALFREDO BORELLI. Twenty-eight Dermoptera (twelve paratypes), Costa Rica (in exchange).

ANNETTE F. BRAUN. Fourteen Microlepidoptera, United States; thirty from Glacier National Park.

BRITISH MUSEUM. Two Butterflies, West Indies.

E. R. BUCKELL. One hundred and ten Orthoptera, British Columbia.

F. R. COLE. Three Diptera, California.

W. J. COXEY. Two *Pyrameis gonerella*, New Zealand; *Papilio weiskei*, New Guinea; *Antheraea suraka*, Madagascar; six Lepidoptera, Australia.

W. C. DUKES. Three *Aegeria tepperi*, Mobile, Alabama.

HENRY FOX. Four Orthoptera, New Jersey and Georgia.

HUGH GIBBON. Seventy-five Butterflies, Manitoba.

FRANK HAIMBACH. Four Moths, Massachusetts.

MORGAN HEBARD. Nine exotic Butterflies; four Odonata, Florida; two hundred and thirty-four Lepidoptera; twenty-seven *Conalcaea coyoterae*, Prescott, Arizona; one hundred and thirty-seven Insects; one Hemipteron, Liberia.

HEBARD-ACADEMY EXPEDITION 1921. Four thousand Orthoptera, western United States.

WHARTON HUBER. Eighty-two Lepidoptera, Borneo, and fifteen from United States; thirteen Coleoptera, Penna.

F. J. KEELEY. One *Phengodes*, Florida.

E. A. KLAGES. Two Coleoptera, Venezuela.

PHILIP LAURENT. Twenty-nine Diptera and Orthoptera, Florida; four Moths, Pennsylvania.

R. A. LEUSSLER. Two *Pamphila ogallala* (paratypes), Nebraska; thirty-three Lepidoptera, Nebraska.

FRANK R. MASON. Three Lepidoptera, Mount Washington, New Hampshire.

LEVI W. MENGEL. Four hundred Oriental Moths.

MUSEU PAULISTA. Thirteen Orthoptera, South East Brazil.

H. M. PARSHLEY. Thirty-two *Aradus*, United States.

A. F. PORTER. Fifty-five Butterflies, Miami, Florida.

PURCHASED. Twenty-four Neotropical Gesperidae; one hundred and seventy-three Orthoptera, South America.

C. T. RAMSDEN. *Xylophanes clarki* (type). Guantanamo, Cuba.

J. C. SELTZER. Trap-door Spider, California.

HENRY SKINNER. Seventy-six Lepidoptera, Arkansas.

STOCKOLM MUSEUM. Thirty-two European Orthoptera (in exchange).

WITMER STONE. Nine Moths, New Jersey.

TRANSVAAL MUSEUM. One hundred and four Blattidae, Transvaal, Natal, thirty-nine species, eighteen paratypes.

UNITED STATES NATIONAL MUSEUM. Thirty-three specimens of Cynipidae (paratypes and cotypes); thirteen Galls.

UNIVERSITY OF MICHIGAN. One hundred and eleven Orthoptera, North Dakota and Michigan.

OTHER INVERTEBRATES

I. S. FISHBLATT. *Geocarcinus ruricola* (L.) from Off Atlantic City, New Jersey.

J. G. MALONE. Seven trays of Invertebrates from Oregon.

D. N. MCCADDEN. *Portunnus sayi* (Gib.) from Ocean City, New Jersey.

C. R. ORCUTT. Two *Balanus* from Lower California.

DR. H. A. PILSBRY. Twelve trays of Invertebrates from the Hawaiian Islands.

CAPT. F. A. POTTS. Two Barnacles from Samoa Islands.

U. S. NATIONAL MUSEUM. Seven Barnacles from California and the Atlantic Ocean.

FOSSIL INVERTEBRATES

LOUIS H. BREGY. Land Shells in a stone from Zion Canyon, Utah.

T. D. A. COCKERELL. Fossil Coral from the Madeira Islands.

MORGAN HEBARD. Fifty-nine species of Shells from Florida and Australia.

CARL B. METZGER. *Lepidodendron* from Pennsylvania.

DR. H. A. PILSBRY. Seven trays of Pleistocene Shells from Oahu Island, Territory of Hawaii.

EMMA WALTER ESTATE. Type of *Murex shilohensis* Heilprin from Cumberland Co., New Jersey.

MINERALS

SAMUEL G. GORDON. Fifteen Pennsylvania Minerals.

FREDERICK HILBIBER and JOHN TALLIS. Collection of Minerals from Perkiomenville, Montgomery County, Penna.

HARRY W. TRUDELL. Samarskite, Mineral Hill, Delaware County, Penna.

ROCKS

SAMUEL G. GORDON. Six Pennsylvania Rocks; Collection of Rocks from the Andes.

PLANTS

CORNETT ARMSTRONG. *Magnolia acuminata*, cultivated.

FRANK BALL. *Panicum flexile* and *Cynosurus cristatus* from Bucks County, Pennsylvania.

G. W. BASSETT. Several collections from New Jersey and Pennsylvania. See also Mrs. J. C. Dorphley, below.

W. M. BENNER. Numerous specimens from Bucks County, Pennsylvania.

CLEMENT BIDDLE. Fungus, *Peridermium cerebrum*, from Virginia.

O. H. BROWN. Twenty-five specimens from Cape May County, New Jersey.

JOHN CAWLEY. *Microstylis ophioglossoides* from Bucks County, Pennsylvania

I. W. CLOKEY. Thirty-two Scrophulariaceae from Colorado.

MRS. J. C. DORPHLEY & G. W. BASSETT. Herbarium of Frank Bassett, containing many specimens, chiefly from New Jersey.

J. W. ECKFELDT. Two specimens from New Jersey and Pennsylvania.

W. C. FERGUSON. *Lycopodium carolinianum* from Long Island.

J. M. FOGG, JR. A few specimens from Philadelphia.

H. W. FOWLER. Two specimens of water-plants from Georgia and Alabama.

C. D. FRETZ. Seventy-five flowering plants from Bucks County, Pennsylvania.

C. D. LIPPINCOTT. *Alopecurus myosuroides* from Swedesboro, New Jersey.

BAYARD LONG. Numerous plants from New Jersey and Pennsylvania.

DR. H. B. MEREDITH. Many local plants, and also collections from northeastern Pennsylvania.

J. C. NELSON. Nearly 1000 specimens, from western Oregon.

NEW YORK BOTANICAL GARDEN. 1400 specimens in exchange.

REV. J. P. OTIS. Fifty plants from Delaware chiefly.

DR. F. W. PENNELL. Two-hundred plants from Nantucket, Massachusetts. Also thirty Scrophulariaceae from various collectors.

H. W. PRETZ. Six hundred specimens, chiefly from Lehigh County, Pennsylvania.

MISS MARGARET SHEPPARD. Seven pine cones collected by J. S. Lippincott and H. N. Bolander, chiefly in California.

DR. WITMER STONE. Many local plants, especially from Cape May County, New Jersey.

F. H. STROHM. Several local plants, chiefly from Bucks County, Pennsylvania.

DR. WILLIAM TRELEASE. Fragment of fungus, *Labrella pomi*, from type in Museum d'Histoire Naturelle, Paris, France.

S. S. VAN PELT. *Euphorbia esula* from Philadelphia.

ARCHEOLOGY

MISS GERTRUDE ABBOTT. Woman's skirt of bark-cloth. Borneo.

DR. W. L. ABBOTT. Stone celt: modern wallet of palm-leaf. Santo Domingo.

R. DALE BENSON JR. Indian blanket of snow-shoe rabbit skins. White Fish, Province of Quebec.

DR. I. MINIS HAYES. Grooved axe-head.

MORGAN HEBARD. Archeological material from an Indian village site. Wisconsin.

J. G. MALONE. Cowry clusters, said to be used as money.

ROYAL ONTARIO MUSEUM OF ARCHAEOLOGY, TORONTO, in exchange. Ancient Tarascan pottery. Mexico.

UNIVERSITY OF ARIZONA MUSEUM, in exchange, Cliff-dwellers' remains: implements, pottery, clothing, etc.

UNIVERSITY OF COLORADO MUSEUM, in exchange. Stone implements from ancient Pueblos, etc.

Reports of Sections.

REPORT OF THE BIOLOGICAL AND MICROSCOPICAL SECTION FOR THE YEAR 1921.—The Biological and Microscopical Section held nine meetings during the year. The membership has slightly increased and the average attendance has been larger than for several years past.

In conjunction with the Mineralogical and Geological Section, twenty-two weekly excursions were made to various localities in Pennsylvania and New Jersey, with an average attendance on each trip of fourteen members and their friends.

Communications were made by the following members: Messrs. Bilgram, T. C. Palmer, Stewart, Van Sickel, Poyser, Munro, Keeley, W. Palmer, Gayhart, and Boyer.

The following were elected officers for the year 1922:

Director..... T. Chalkley Palmer
Vice-Director..... John A. Shulze
Recorder..... Charles S. Boyer
Corresponding Secretary..... Walter Palmer
Treasurer..... Thomas S. Stewart
Conservator..... F. J. Keeley

CHARLES S. BOYER,
Recorder.

ENTOMOLOGICAL SECTION.—All the stated meetings of the Section have been held, with an average attendance of twelve persons. Interesting communications and exhibits have been made by the members, contributors, and occasional visitors. Messrs. John C. Hollinger, Max Kisliuk, Jr., Richard C. Norris, Jr., and R. C. Hutchison, were elected Contributors.

The officers and committee elected to serve for 1922 are:

Director..... Philip Laurent
Vice-Director..... R. C. Williams, Jr.
Recorder..... E. T. Cresson, Jr.
Secretary..... J. A. G. Rehn

Treasurer..... E. T. Cresson
Conservator..... Henry Skinner
Publication Committee: E. T. Cresson, P. P. Calvert, E. T. Cresson, Jr.

E. T. CRESSON, JR.,
Recorder.

MINERALOGICAL AND GEOLOGICAL SECTION.—As was the case during previous years, the chief activities of the Mineralogical and Geological Section have been confined to the weekly excursions, jointly with the Microscopical and Biological Section, during the Spring and Fall months, when many interesting localities were visited.

At a recent meeting, Mr. Samuel G. Gordon described his expedition to South America and exhibited a number of the more interesting minerals collected.

The following were elected officers to serve during the ensuing year:

Director..... F. J. Keeley
Vice-Director..... T. Chalkley Palmer
Conservator..... George Vaux, Jr.
Treasurer..... Thomas S. Stewart
Recorder and Secretary..... Samuel G. Gordon.

F. J. KEELEY,
Director.

ORNITHOLOGICAL SECTION.—The Ornithological Section has exerted itself during the year to increase interest in the department of birds. The Delaware Valley Ornithological Club has continued to hold its meetings in the building, and the American Ornithologists' Union convened here in November in its 39th annual meeting, bringing ornithologists from all parts of the United States and Canada to the Academy.

Officers elected to serve for the ensuing year are:

Officers..... Spencer Trotter,
Vice-Director..... George Spencer Morris
Recorder..... Julian K. Potter
Secretary..... William A. Shryock
Treasurer and Conservator..... Witmer Stone.

Public Lectures.

The free public lectures given at the Academy under the auspices of the Ludwick Institute, were continued in the 1921 season. Sixteen evening lectures were given with a very gratifying attendance at each. The Lecture Committee was fortunate in obtaining prominent naturalists from other institutions who presented impressions of their field work and studies in various parts of the world. Among these were, Mr. Herbert Lang, Assistant Curator, Dept. of Mammalogy, American Museum of Natural History, N. Y., who spoke on "Big Game and Peoples of the Belgian Congo." Dr. Robert C. Murphy, Museums of the Brooklyn Institute of Arts and Science, who told about "The Penguins of South Georgia Island." "Six Years of an Ornithologist in the Belgian Congo," given by James P. Chapin, of the Dept. of Ornithology, American Museum of Natural History, and the last lecture of the Evening Course was given by Dr. J. Chester Bradley, Professor of Entomology, Cornell University, "An Entomologist's Journey through Junin and Loreto Provinces of Peru." Lectures by the resident staff were interspersed among the out of town speakers. A series of twelve Friday afternoon lectures were given by members of the resident staff, for school children. These were primarily of the local fauna and flora and more or less elementary in character. Information was sent to the principals of the public and private schools in and near Philadelphia, by means of letter and the local newspapers. Many of the schools availed themselves of these lectures which would seem to warrant their repetition next year.

Three lectures were given on consecutive Sunday afternoons, as an experiment, in February: February 6th, Dr. Witmer Stone, "A Naturalist in Arizona"; February 13th, Dr. Henry A. Pilsbry, "The Hawaiian Islands and the Volcano of Kilauea"; and February 20th, James A. G. Rehn, "Deserts and Mountains of California and Nevada." These lectures were very well attended and seemed to reach a new class of people, who had not been in touch with the work of the Academy before. Many regrets were expressed that this Sunday course was only for three Sundays. The attendance was so gratifying that the Academy and the Ludwick Institute would seem justified in continuing and extending these Sunday talks next year.

Library.

ADMINISTRATION OF THE LIBRARY.

LIBRARY COMMITTEE.

WITMER STONE, *Chairman*, F. J. KEELEY
HENRY TUCKER T. CHALKLEY PALMER
SPENCER TROTTER.

SPENCER TROTTER, *Librarian.*
WILLIAM J. FOX, *Assistant Librarian.*

REPORT OF THE LIBRARIAN.

During 1921 the additions to the library total 7545, showing an increase of 621 over the preceding year. The pamphlets and parts of periodicals added are 5908, 762 are volumes, 296 maps, and 581 autograph letters from various contemporary naturalists to the late S. S. Haldeman, were presented by his grandson, Mr. Guy K. Haldeman.

The various sources of accession are as follows:

Exchange	3085
Isaiah V. Williamson Fund	2345
United States Department of Agriculture	733
Mr. Guy K. Haldeman	576
John Aitken Meigs Fund	326
Authors	47
Kentucky Department of Geology and Forestry	45
Museum of the American Indian, Heye Foundation	30
Imperial Department of Agriculture, British West Indies	24
New York State College of Agriculture	24
Editors	24
Thomas B. Wilson Fund	23
American Entomological Society	22
Pennsylvania State Library	16
New York Agricultural Experiment Station	14
Ministère des Colonies, Royaume de Belgique	13
Texas Agricultural Experiment Station	12

United States Department of Commerce	12
Utah Agricultural Experiment Station	11
Department of Agriculture, State of California	8
New York Aquarium	8
Cornell University Agricultural Experiment Station	7
Cuerpo de Ingenieros de Minas del Peru	7
Estate of Edward J. Nolan	6
Publication Committee of the Academy	6
Department of Conservation and Development, New Jersey	5
Mississippi State Geological Survey	5
Dr. William L. Abbott	4
Department of Marine and Fisheries, Canada	4
Argentine Government	4
Geological Survey of Victoria	4
Biological Board of Canada	4
California State Fish and Game Commission	3
Imperial Entomologist, Pusa India	3
Dr. Henry Skinner	3
United States War Department	3
Observatorio Meteorologico de la Escuela Normal de Varones	2
Lowell Observatory	2
State Geologist of South Dakota	2
Survey of India	2
Statens Skogsförsöksanstalt	2
National Research Council	2
New York State Archeological Association, Morgan Chapter	2
Geological Survey of Georgia	2
University of Washington	2
Government of the Phillippine Islands	2
Carleton College	2
San Diego Society of Natural History	2
South Dakota School of Mines	2
University of Idaho	2
Mr. Philip Ainsworth Means	2
Michigan College of Mines	2
Pennsylvania Topographic and Geological Survey	2
Dr. W. W. Keen	2
New York State Library	2
Library of Congress	1
Japan Society	1
New South Wales, State Fisheries	1
Boston City Hospital	1
Charles Lathrop Pack	1
Wagner Free Institute of Science	1
Department of Naval Service, Canada	1
National Forest Reservation Commission	1
Société Hollandaise des Sciences à Harlem	1

Observatorio de Madrid	1
Colorado Museum of Natural History	1
North Carolina Geological and Economic Survey	1
Rockefeller Institute for Medical Research	1
French Government	1
Health Department of the Panama Canal	1
Rhinebeck Bird Club	1
William J. Fox	1
Southwest Museum	1
University of Tennesee	1
Albert Ier, Prince de Monaco	1
Tokyo Imperial Museum	1
Conseil International de Recherches	1
Michigan Geological and Biological Survey	1
Scientific Society of San Antonio	1
Dr. Philip P. Calvert	1
Hercules Powder Company	1
Board of Water Supply of New York City	1
Messrs. Vechting Waring Company, New York City	1
Government of Formosa	1
Entomological Society of Nova Scotia	1
Geological Survey of Alabama	1
Raffles Museum and Library	1
Zoological Society of Philadelphia	1
Board of Scientific Advice for India	1
Provincial Museum of Natural History	1
Surgeon General, U. S. A.	1
Government of India	1
South Dakota Geological Survey	1
P. Blakiston's Son and Co., Philadelphia	1
Philadelphia Museums	1
Queensland Department of Mines	1
Commissioners on Fisheries and Game, Massachusetts	1
Haverford College	1

These have been distributed to the various departments as follows:

Journals	5038
Agriculture	750
Geology	385
Botany	310
Geography	123
General Natural History	85
Entomology	64
Voyages and Travels	57
Mineralogy	28
Anatomy and Physiology	20

Ornithology	20
Anthropology	19
Ichthyology	13
Conchology	12
Helminthology	12
Herpetology	10
Physical Sciences	8
Bibliography	6
Mammalogy	2
Chemistry	1
Medicine	1
Autograph Letters	581

These journals and transactions, new to the library, were added, either by purchase or exchange:

Acta Academia Aboensis. Abo.
Acta Forestalia Fennica. Helsingfors.
Acta Zoologica. Stockholm.
American Museum Novitates. New York.
Archiv für Molluskenkunde. Frankfurt a. M.
Archives Néerlandaises de Physiologie de l'Homme et des Animaux, La Haye.
Bataafsch Genootschap der Proefondervindelijke Wijsbegeerte, Rotterdam. Verslag der Voordrachten van Leden.
Congreso Nacional de la Industria Minera, Lima. Anales.
Conseil International de Recherches (Section d'Océanographie Physique). Bulletin.
Department of Agriculture, Trinidad and Tobago. Memoirs.
Department of Conservation State of Indiana. Publications.
Department of Geology and Forestry of Kentucky. Publications.
Faculte des Sciences de l'Université Masaryk. Brno. Publications.
Genetica. 's-Gravenhage.
Guam Agricultural Experiment Station. Circular.
Hawaiian Volcanic Observatory. Weekly (Monthly) Bulletin.
Hereditas Genetisk Arkiv. Lund.
Illinois State Academy of Sciences, Urbana. Transactions.
Journal of Comparative Psychology, Baltimore.
Kryptogamische Forschungen (Bayerische Botanische Gesellschaft). München.
Micrographe (Le) Preparateur, Paris.
Prometheus, Berlin.
Psychobiology, Baltimore.
Revue d'Ethnographie et des Traditions Populaires, Paris.
Rhinebeck Bird Club. Yearbook.
Rockefeller Institute for Medical Research, New York. Monographs.
School of Forestry University of Idaho. Bulletin.
Senckenbergiana. Frankfurt A. M.
Sociedad Iberica de Ciencias Naturales, Zaragoza. Memorias.
Société d'Études des Sciences Naturelles de Nimes. Bulletin

Société Géologique et Minéralogique de Bretagne, Rennes. Bulletin.
Stazione Zoologica di Napoli. Pubblicazioni.
University of California Record.
Stanford University Publications (Series in Mathematics and Astronomy, Biological, and Languages).
Zeitschrift für die gesammte Anatomie (I. Abteilung,—Zeitschrift für Anatomie und Entwicklungsgeschichte), München.
Zeitschrift für technische Biologie (*continuation* of Zeitschrift für Gärungsphysiologie, u. s. w.), Berlin.

Among the important additions to the library is a collection of twenty-six volumes of the works of Linnaeus, representing chiefly editions not hitherto in the possession of the Academy. A fine copy of J. C. D. Schreber, Beschreibung der Gräser, Folio, Leipzig, 1769–1810, was acquired by purchase.

Eight hundred and fourteen volumes have been bound; and 170 pamphlets and 33 volumes on subjects not pertinent to the Academy's objects, were transferred to the Free Library of Philadelphia.

Fourteen hundred and thirty volumes and parts of periodicals were used on the premises by the scientific staff; and 185 volumes were borrowed by members

A framed portrait, in oil by Hewitt, of the late Dr. Edward J. Nolan, Librarian of the Academy, 1867–1921, and portraits of the late Dr. Joseph Leidy, and J. Dickinson Sergeant, who was Librarian from 1862 to 1866, were received from the Estate of Edward J. Nolan.

WILLIAM J. FOX,
Acting Librarian.

Secretaries.

REPORT OF THE RECORDING SECRETARY.

The outstanding duty of the Recording Secretary in the present report is the sad one of bringing to the attention of the members of the Academy the passing of one who for many years contributed this report, and for over half a century was so closely and intimately associated with the institution and its activities,—Dr. Edward J. Nolan. In deference to the wish specifically expressed in his last testament, an injunction from a departed and beloved friend and colleague, no biographical sketch of Dr. Nolan's life has been published by the Academy. At the Academy meeting of January 18, 1921, shortly after his death, an appreciation of Dr. Nolan and his work was read by the President, Mr. Cadwalader. This well-earned tribute to the steadfast devotion of the departed, will, in consequence of his prohibition, be recorded solely upon the minutes of the Academy.

Elected Recording Secretary of the Academy December 29, 1874, Dr. Nolan served continuously in that post until, on account of failing health, he was relieved of the responsibilities of the office. At the meeting of the Academy held November 16, 1921, he was elected Recording Secretary Emeritus, and the present incumbent was nominated to handle the active work of the office. Unfortunately, for but a few weeks was our friend permitted to enjoy the honored calm of work well-done, as, on January 7, 1921, he passed away.

Meetings of the Academy have been held December 21, 1920; January 18, February 15, March 15, April 19 and November 15, 1921. The average attendance at the meetings was twenty-six members and forty-three visitors. Communications were made by Dr. William E. Hughes, Arthur H. Fisher, Dr. Henry Skinner, J. Fletcher Street, and James A. G. Rehn.

During the past year thirteen members have died and five have resigned. The following individuals were elected members:

T. Ellis Barnes, R. Dale Benson, Jr., Mrs. Andrew Alexander Blair, Dr. Joseph Hall Bodine, Mrs. Edward Bok, Lambert Cadwalader, Dr. John B. Carson, John D. Carter, Wilson Catherwood, Charles D. Clark, Dr. C. Montague Cooke, Alexander Brown Coxe, Mrs. James H. R. Cromwell, George K. Crozer, Jr., Edwin S. Dixon, Jr., Archibald M. L. duPont, E. Paul duPont, Thomas Langdon Elwyn, William Newbold Ely, Samuel S. Fels, Mrs. Stanley G. Flagg, Jr., C. F. Fox, Stephen Fuguet, Mrs. Eva B. Gadsby, Thomas S. Gates, John Gilbert, Henry Frazer Harris, George L. Harrison, Mrs. Charles W. Henry, John C. Holinger, Wharton Huber, Charles F. Jenkins, Dr. Victor A. Loeb, C. Christopher Morris, Frederick Wistar Morris, Jr., Dr. Samuel Copeland Palmer, Dr. Francis W. Pennell, Thomas Robins, John W. Schell, Dr. William Randolph Taylor, John Wagner, Miss Hepsey Norris Wells, Dr. D. H. Wenrich, Dr. Arthur DeWitt Whedon, and Walter Wheeler.

By action of the Council the direction of a membership campaign was placed in charge of the Recording Secretary. The first stage of this campaign has been carried out, with very gratifying success, and a continuation of the work in new directions and along special lines is planned for 1922.

Changes in the By-Laws of the Academy were adopted by the Academy February 15, 1921, which provide for six classes of members: Benefactors, Sustaining Members, Life Members, Annual Members, Associate Members, and Junior Members. Briefly summarized the requirements of these classes are: Benefactors make a contribution of $10,000; Sustaining Members, one of $1,000; Life Members, one of $100; Annual Members, an annual contribution of $10; Associate Members are required to reside at least fifty miles from Philadelphia City Hall, and to make an annual contribution of $5; Junior Members are required to be less than twenty-one years old when elected, and to make an annual contribution of $3. Neither Associate nor Junior Members can vote or hold office, and at the age of twenty-five Junior Members pass automatically to the class of Annual Members.

Additional amendments to the By-Laws, adopted the same date as those relative to membership classes, removed from the Recording Secretary the necessity of being Editor of the publications of the Academy, and placed in the hands of the Publication Committee,

subject to the approval of the Council, the selection of the Editor.

The Recording Secretary desires to express to the officers and councilors of the Academy, his appreciation of the consideration shown and assistance given his efforts to discharge satisfactorily the duties so ably handled by the experienced hands of his predecessor in office.

JAMES A. G. REHN,
Recording Secretary.

REPORT OF THE CORRESPONDING SECRETARY.

The deaths of correspondents reported during the year were as follows: Joel A. Allen, Wm. A. Buckhout, and Charles B. Cory. No correspondents were elected.

As indicating the renewal of the international exchange of amenities between scientific and educational institutions an increased number of invitations was received. Among the more important of these events were the fifty-year jubilee of the Geological Society of Stockholm; the twenty-fifth annual meeting of the American Academy of Political and Social Science, to which the President appointed Dr. Macfarlane, Dr. Stone, and the corresponding secretary as delegates; the centenary celebration of the founding of the Philadelphia College of Pharmacy and Science to which Mr. Rehn was made a delegate; the Second International Congress of Eugenics at which the Academy was represented by Professors Conklin and McClung; the inauguration of Dr. J. M. Thomas as President of Pennsylvania State College; the semicentenary of the Society for the Study of the Fauna and Flora of Finland; the seven-hundreth anniversary of the founding of the University of Padova; the postponed International Geological Congress to be held in Brussels; and the organization under the auspices of the National Research Council of an Institute for Research in Tropical America to which Dr. Stone was delegated to represent the Academy. To those gatherings at which representation of the Academy was impractical letters of felicitation or addresses were sent.

From the American Ornithologists' Union was received a resolution thanking the Academy for courtesies extended during its thirty-fifth stated meeting.

A copy of a bronze medalion commemorative of its semi-centennial celebration was received from the Wisconsin Academy of Sciences, Arts and Letters.

Other correspondence was conducted as usual.

Communications received:

Acknowledging the receipt of the Academy's publications	147
Transmitting publications to the Academy	43
Requesting exchanges or the supply of deficiencies	15
Photographs of correspondents	2
Invitations to learned gatherings, celebrations, etc.	12
Notices of deaths of scientific men	6
Circulars concerning the administration of scientific and educational institutions, etc.	17
Letters from correspondents and miscellaneous letters	84
Total received	326

Communications forwarded:

Acknowledging gifts to the Library	822
Requesting the supply of deficiencies	170
Acknowledging gifts to the Museum	
Acknowledging photographs and biographics of correspondents	2
Letters of sympathy or congratulation, addresses, etc.	8
Diplomas and notices of election of correspondents, and delegates' credentials	7
Miscellaneous letters	103
Annual reports and circulars sent to correspondents	190
Total forwarded	1302

J. PERCY MOORE,
Corresponding Secretary.

Publications.

PUBLICATION COMMITTEE.

HENRY SKINNER, *Chairman*, · WITMER STONE,
HENRY A. PILSBRY, WILLIAM J. FOX, MILTON J. GREENMAN.
EDITOR: WILLIAM J. FOX.
Artist: HELEN WINCHESTER.

With the appearance of the number now on the press, 1921, Part II, the Academy will have published 559 pages and 49 plates of its PROCEEDINGS for 1921. The Annual Reports for 1920, forming 57 pages and 6 plates, were issued in separate form, and not with the PROCEEDINGS, as in the past.

The Entomological Section of the Academy published 330 pages and 5 plates of the ENTOMOLOGICAL NEWS; and the American Entomological Society with the cooperation of the Academy 268 pp. and 15 plates of its TRANSACTIONS.

Dr. Pilsbry, editor of the MANUAL OF CONCHOLOGY, has issued during the year parts 101, 102, and 103, of that publication, or 192 pages and 18 plates.

With the exception of Russia, exchange of publications has been resumed with institutions in countries closed during the world war.

WILLIAM J. FOX
Secretary of the Committee.

Treasurer.

SUMMARY OF THE ACCOUNTS OF GEORGE VAUX, JR., TREASURER OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, FOR THE FISCAL YEAR ENDED NOVEMBER 30, 1921

GENERAL FUND

RECEIPTS.

Balance on hand 30th November, 1920		1,869.93
Income from investments		44,233.99
Income from Estate of John Turner, dec'd		152.35
Annual dues		2,235.00
Interest on Bank Balances		420.09
Publications sold		505.79
Income Account of 1309 Arch Street		198.35
Transfer from Funds:—		
Jeanes Fund for Museum Expenses	800	
Wilson Fund for Librarian's salary	400	
		1,200.00
		$50,815.50

PAYMENTS.

Refunded to Wm. S. Vaux Fund, for part of cost of goniometer	250.00
General expenses, including fuel, light, water, building repairs, etc.	6,774.36
Petty expenses	300.00
Binding	1,491.95
Recording Secretary, salary and expenses	722.46
Printing Proceedings	2,705.48
Specimens and Expeditions	337.01
Expenses of Treasurer's Department	535.68
Salaries in Curators' Department	27,143.64
Salaries in Librarian's Department	2,458.34
Museum Cases	836.00
Librarian's expenses	113.27
Corresponding Secretary's expenses	40.00
Mary S. Warren, on account of 1309 Arch Street	1,800.00
Estate of Robert H. Lamborn, dec'd., for taxes, etc., on lands in Colo.	3,250.00
Balance on hand 30th November, 1921	2,057.31
	$50,815.50

CONCHOLOGICAL SECTION FUND

RECEIPTS.

Net Income collected	492.59
Balance overdrawn 30th November, 1921	912.37
	$1,404.96

PAYMENTS

Balance overdrawn 30th November, 1920	1,304.96
Cash to S. Raymond Roberts	100.00
	$1,404.96

COPE COLLECTION FUND

RECEIPTS.

Balance on hand 30th November, 1920	2,365.10
Net Income collected	782.88
Balance on hand 30th November, 1921	$3,147.98

F. V. HAYDEN MEMORIAL FUND

RECEIPTS.

Net Income collected	102.22

PAYMENTS.

Balance overdrawn 30th November, 1920	50.99
Balance on hand 30th November, 1921	51.23
	$102.22

HORACE N. POTTS FUND

RECEIPTS.

Balance on hand 30th November, 1920	57.16
Net Income collected	481.16
Balance on hand 30th November, 1921.	$475.32

MARY JEANES MUSEUM FUND

RECEIPTS

Balance on hand 30th November, 1920	13.09
Net Income collected	870.00
	$883.79

PAYMENTS.

Tranferred to General Fund for Museum expenses	800.00
Balance on hand 30th November, 1921	83.79
	$883.79

JESSUP FUND, MALE BRANCH

RECEIPTS.

Balance on hand 30th November, 1920	684.53
Net Income collected	630.02
	$1,314.55

PAYMENTS.

Salaries to students	810.00
Balance on hand 30th November, 1921	504.55
	$1,314.55

JESSUP FUND, FEMALE BRANCH

RECEIPTS.

Balance on hand 30th November, 1920	93.03
Net Income collected	222.86
	$315.89

PAYMENTS.

Salaries to students	223.40
Balance on hand 30th November, 1920	92.49
	$315.89

J. A. MEIGS LIBRARY FUND

RECEIPTS.

Balance on hand 30th November, 1920	162.86
Net Income collected	555.47
Balance overdrawn 30th November, 1921	1,067.24
	$1,785.57

PAYMENTS.

Books purchased	1,785.57
	$1,785.57

J. H. REDFIELD MEMORIAL FUND

RECEIPTS.

Balance on hand 30th November, 1920	171.92
Net Income collected	192.71
Accumulated Income in hands of late Treasurer of Botanical Fund transferred back into this account	388.13
	$752.76

PAYMENTS.

Transferred to Botanical Section	296.40
Balance on hand 30th November, 1921	456.36
	$752.76

MARY REBECCA DARBY SMITH FUND

RECEIPTS.

Balance on hand 30th November, 1920	113.01
Net Income collected	71.52
	$184.53

PAYMENTS.

Balance on hand 30th November, 1921	184.53
	$184.53

AUBREY H. SMITH FUND

RECEIPTS.

Balance on hand 30th November, 1920	1,745.65
Net Income collected	735.51
	$2,481.16

PAYMENTS.

Balance on hand 30th November, 1921	2,481.16
	$2,481.16

FRANCES LEA CHAMBERLAIN FUND

RECEIPTS.

Balance on hand 30th November, 1920	480.38
Net Income collected	110.83
	$591.21

PAYMENTS.

Balance on hand 30th November, 1921	591.21
	$591.21

THOMAS B. WILSON FUND

RECEIPTS.

Balance on hand 30th November, 1920	235.15
Net Income collected	488.35
	$723.50

PAYMENTS.

Books purchased	225.52
Transferred to General Fund for Librarian's salary	400.00
Balance on hand 30th November, 1921	97.98
	$723.50

WILLIAM S. VAUX FUND

RECEIPTS.

Balance on hand 30th November, 1920	1,561.43
Net Income collected	479.75
Transferred from General Fund towards cost of goniometer	250.00
	$2,291.18

PAYMENTS.

Minerals purchased	1,153.10
Cost of goniometer	303.00
Balance on hand 30th November, 1921	835.08
	$2,291.18

I. V. WILLIAMSON FUND

RECEIPTS.

Balance on hand 30th November, 1920	38.51
Net Income collected	1,457.81
Balance overdrawn 30th November, 1921	115.30
	$1,611.62

PAYMENTS.

Books purchased	1,611.62
	$1,611.62

SPECIAL DONATIONS

RECEIPTS.

Balance on hand 30th November, 1920	689.38
Donations received	600.00
	$1,289.38

PAYMENTS.

Expenditures for cases, membership campaign, etc.	768.05
Balance on hand 30th November, 1921	521.33
	$1,289.38

J. F. BEECHER MEMORIAL LABORATORY FUND

RECEIPTS.

Balance on hand 30th November, 1920	2,229.83
Net Income collected	940.83
Balance on 30th November, 1921	$3,170.66

GENERAL ENDOWMENT FUND.

RECEIPTS.

Balance on hand 30th November, 1920	373.79
Net Income collected	179.67
Balance on 30th November, 1921	$553.46

Respectfully submitted,

GEORGE VAUX, JR.,
Treasurer.

E. and O.E.
Philadelphia.
November 30, 1921.

We herewith report that we have made an audit of the books and accounts of George Vaux Jr., Esq., Treasurer of the Academy of Natural Sciences of Philadelphia, for the fiscal year ended November 30th, 1921.

As the result of our audit we certify the above statements are in accord with the records of the Girard Trust Company, Agent, and with the Treasurer's books, respectively, and are in our opinion correct.

All of the income received during the year was accounted for and entered upon the books. The payments, as shown by the Cash Book, were properly supported by statements, checks, or vouchers, and were found to be correct. A reconciliation of the deposit account with the Girard Trust Co., was made by us and the correctness of the Cash Balance as shown by the Treasurer's books verified thereby.

All of the securities owned as shown by Schedule "A" were in the custody of the Girard Trust Company as Agent and were examined by us with the exception of two bonds and mortgages which were not produced for our inspection

December 19th, 1921. (Signed) EDWARD P. MOXEY & CO.
Certified Public Accountants.

REPORT OF THE TREASURER OF THE MANUAL OF CONCHOLOGY

The Treasurer of the "Manual of Conchology" respectfully reports that:

During the year ending November 30th, 1921, the receipts from all sources were	1,226.02
And disbursements	890.35
Leaving a balance of	335.67
Adding to this, balance December 1, 1920	183.81
Leaves balance December 1, 1921	$519.48

The receipts were as follows:

From Subscriptions, Manual Vol. XXV	27.50	
" Subscriptions, Manual Vol. XXVI	871.07	
" Sale of back volumes and parts	220.10	
" Academy of Natural Sciences	100.00	
" Interest on daily Bank Balances	7.35	
		$1,226.02

The disbursements were:

For Engraving and printing plates,	105.50	
" Colorists	58.00	
" Paper and printing	532.95	
" Binding parts	53.87	
" Postage, Expressage, etc	34.53	
" Payment of loan from, H. A. Pilsbry	25.00	
" Refund to Geo. M. Crofts	1.00	
" Wm. Wesley and Son, Transfer from Deposit account	79.50	
		890.35

The Balance on hand	519.48
is subdivided as follows:	
For "Manual" Account	443.23
Wesley and Son, on deposit subject to call	76.25

The Publication Committee has continued to assume payments of salaries of Editor, Conservator, and Draughtsman, formerly charged to the "Manual", which has relieved it of a heavy burden upon its resources.

Respectfully submitted,
S. RAYMOND ROBERTS,
Treasurer.

November 30, 1921.

ANNUAL REPORTS

The Academy of Natural Sciences

OF

Philadelphia

FOR THE YEAR ENDING NOVEMBER 30, 1922

EXPLORATIONS
NATURAL HISTORY MUSEUM
SECTIONS
PUBLIC LECTURES
LIBRARY
PUBLICATIONS
SECRETARIES
TREASURER

PHILADELPHIA
1923

ANNUAL REPORTS

The Academy of Natural Sciences

OF

Philadelphia

FOR THE YEAR ENDING NOVEMBER 30, 1922.

Officers and Council 1923

President.

R. A. F. PENROSE, JR.

Vice Presidents.

EDWIN G. CONKLIN, HENRY SKINNER.

Recording Secretary.
JAMES A. G. REHN.

Corresponding Secretary.
J. PERCY MOORE.

Treasurer.

GEORGE VAUX, JR.

Librarian.

SPENCER TROTTER.

Curators.

WITMER STONE, GEORGE L. HARRISON, Jr.,
HENRY A. PILSBRY, T. CHALKLEY PALMER.

Additional Members of the Council.

Class of 1923.

CHARLES B. PENROSE, ROSWELL C. WILLIAMS, JR.,
WILLIAM E. HUGHES. THOMAS S. GATES.

Class of 1924.

PHILIP P. CALVERT, WALTER HORSTMANN,*
FRANK J. KEELEY, HENRY TUCKER.

Class of 1925.

JOHN CADWALADER, MILTON J. GREENMAN,
ROBERT G. LECONTE, MORGAN HEBARD.

COMMITTEES 1923.

Committee on Accounts (elected by the Academy, December 19, 1922): Roswell C. Williams, Jr., *Chairman*, Samuel N. Rhoads, John G. Rothermel, Thomas S. Stewart, Walter Horstmann.*

COMMITTEES ELECTED BY THE COUNCIL, DECEMBER 22, 1922.

Finance: Effingham B. Morris, *Chairman*, Walter Horstmann,* George L. Harrison, Jr., Morgan Hebard, and the Treasurer.

Publications: Henry A. Pilsbry, *Chairman*, Witmer Stone, William J. Fox, Milton J. Greenman, J. Percy Moore.

Library: Witmer Stone, *Chairman*, Henry Tucker, F. J. Keeley, T. Chalkley Palmer, Spencer Trotter.

Instruction: Henry Skinner, *Chairman*, Henry A. Pilsbry, Spencer Trotter, Roswell C. Williams, Jr., Wharton Huber.

COMMITTEES APPOINTED BY THE PRESIDENT.

By-Laws: Spencer Trotter, *Chairman*, Charles B. Penrose, Walter Horstmann.*

Nomination of Correspondents: Henry Skinner, *Chairman*, Witmer Stone, J. Percy Moore.

* Deceased December 30, 1922.

NESTING COLONY OF WAGLER'S OROPENDOLA (*Zarhynchus wagleri*).

REPORT OF THE CURATORS

Special Reports by Members of the Scientific Staff

THE ACADEMY NICARAGUAN EXPEDITION OF 1922

BY WHARTON HUBER.

During the latter part of the summer of 1921, Dr. Theodore W. Bouchelle, a member of the Academy, suggested that an expedition be sent to Nicaragua to study and collect specimens of its fauna, generously offering to act as host after the expedition reached Prinzapolka. Having lived in Central America for some seventeen years, the greater part of this time in Nicaragua, he realized the possibilities for collecting under the most favorable conditions at Eden, where he was then stationed. Very little scientific collecting has been done in eastern Nicaragua in what is known as the Moskito Coast region, and apparently none whatever in the vicinity of Eden. It was the writer's good fortune to be intrusted with the plans for an expedition and the carrying out of the same for a three months stay in the tropical forest. Mr. J. Fletcher Street, a member of the Academy, accompanied the writer and assisted in the field work. Since we planned to make collections in as many branches of natural history as possible, a considerable amount of equipment and baggage was necessary.

We sailed for Bluefields from New Orleans on March 3, 1922, on the S. S. "Hibueras" of the New Orleans-Bluefields Fruit & Navigation Co.

Shortly after leaving the dock a large flock of Ring-billed Gulls followed in the wake of the ship, wheeling and circling close to the stern, ever watchful for a morsel of food. They continued their graceful flight as we steamed down the Mississippi and out into the Gulf, slowly diminishing in numbers until the coast of Cuba was in

sight, when the last small remnant of the flock left us, disappearing in the direction of Cape San Antonio, the westernmost extremity of Cuba. Very little bird life was observed in the Gulf, a single White Pelican and a Parasitic Jaeger completing the list. Upon entering the Straits of Yucatan a small flock of swallows greeted us by passing close to the ship, the forerunners of many species to be seen before we passed through the Carribean; and Frigate Birds, whose graceful flight one never tires of watching, Yellow-billed Tropic Birds, and dusky colored Boobies in pairs, whose tandem flight was both swift and graceful.

In the Gulf Stream flying-fish were plentiful, their gauzy fins glistening in the sunlight as they arose in schools close by. Much of our time was spent in the bow of the ship, figuring their speed as they "volplaned" into the wind. This we determined was at about 15 miles per hour, or a little faster; their "flights" were from a few feet to as much as 125 or 150 yards. The fins were not moved in flight but were kept rigid, and the longest distances were obtained when flying directly into the wind. Occasionally, when the flight of a fish was nearly spent, it would strike its tail upon the water, thus elevating its body and continue for a considerable distance further. One of these flying-fish came aboard during the night and we preserved it in formaldehyde.

At nine P.M., March 7, we dropped anchor, one and one-half miles off Bluefields, too late for the pilot to come out that day. Six o'clock the next morning found the pilot clambering up the rope ladder and at seven we were alongside the Customs Dock at the Bluffs. Captain Moore introduced us to Mr. Crompton, in charge of Customs, who had our baggage and equipment passed without the formality of opening. Our thanks and appreciation are due Mr. Crompton, Mr. Le Franc, Mr. Arnaldo Papi, the many Customs' officials, and the representatives of the Nicaraguan Government.

Seven miles across the lagoon from the Bluff is Bluefields, the largest town on the Atlantic side of Nicaragua; attractive from the waterfront, but decidedly disappointing when one moves about the grass grown streets lined with nondescript buildings generally roofed with corrugated iron. What the town lacked in beauty it more than made up in hospitality, comfortable quarters, and excellent food. The next three days were spent collecting birds in the bush back of Bluefields where we took a number of species that

were not found at Eden. Many photographs were taken in and around Bluefields, and we continued to take pictures during our entire stay in Nicaragua, so that when we returned we had about seven hundred negatives.

Before leaving Philadelphia, Mr. Charles R. Miller, Vice-President of the Eden Mining Company, offered to take us on the schooner that was to carry him from Port Lamon, Costa Rica, to Prinzapolka, and continue in his party up the river in pitpans to Eden. This kindness of Mr. Miller's simplified our travelling very much, shortening the time spent on the river, besides giving us the greatest possible comfort and enjoyment. It was therefore a great pleasure to us when we joined Mr. Miller and Mr. Blackburn on board the "Ultramar" at the Bluff, at noon on March 13. The "Ultramar" is a fifty foot, two-masted schooner, of about 40 tons, fitted with an auxiliary engine. At eight o'clock, with a beautiful moon over head, we left the Bluffs, crossed the bar under our auxiliary, then hoisted our sails, and set a course for Prinzapolka, ninety miles up the coast. The trade wind was blowing strong, and the sea very rough, so we stayed close to our mattresses spread on top of the engine house. Many times during the night the mattress slid with the pitching of the schooner, and I thought that I would land in the scuppers, or on the back of the big black hog that roamed the deck as a mascot.

There is very little water on the bar at the entrance to the Prinzapolka River and in crossing we struck several times. Large steamers that load mahogany logs anchor well off the coast, and the logs are rafted and towed off to them by power boats. We reached the wharf of the Tunky Transportation Company at ten o'clock, and our equipment was immediately transferred to a pitpan.

All the arrangements for the river journey of 180 miles to Eden having been made by Captain Osmond Thompson, we were free to observe and collect a few birds. Two pitpans each fifty feet long, five and one-half feet wide, and hollowed from a single mahogany log, with a canvas cover over the middle long enough to shelter our air-mattresses from the rain, were lashed on either side of a gasoline power boat. Mr. Miller and Mr. Blackburn occupied one pitpan; Mr. Street and myself the other. Captain Osmond Thompson, a cook, and ten Moskito Indians, made up the balance of the party. We left the wharf of the Tunky Transportation

Company a little after six o'clock, and darkness, almost immediately following the setting of the sun in this latitude, fourteen degrees north, was already upon us. A full moon cast its silvery light through the giant tropical trees, silhouetting wonderous fantastic castles and other grotesque forms against a brilliant starlit sky. Here and there were great palms that furnished quantities of nuts to the United States during the war, to be burned into charcoal for the making of gas-masks. Now and then the weird cry of a night-prowling animal or bird, and above all the steady swish of the water against the bows of our pitpans, leave pleasant memories of a night never to be forgotten.

Daylight found us in the Banbana River, much narrower than the Prinzapolka, but even more beautiful. Forest giants everywhere with their leaves of many shades of green; now and then a cotton tree towering above its neighbors with a colony of Oropendolas, called in Nicaragua Yellow Tails, decorating its topmost outer branches with a dozen or twenty long brown flask-shaped nests, four or five feet in length. Herons, blue and white, Egrets, Wood Ibises, and even our own familiar little Spotted Sandpiper, flew from some favorite spot along the bank at our approach. The Iguanas, or Cocomos of the Moskito Indians, basking in the sun along the banks, or feeding on the younger leaves of a bamboo, were seen in abundance, for March is the month when the Cocomo lays her eggs, forty to sixty in number, buried in some sandy sunny spot. The eggs and meat of the Cocomo are much sought for food by the Indians, the meat tasting like frog legs or very tender chicken. An occasional Crocodile, basking in the sun, scurried from its watchful sleep with a splash, and was seen no more. Overhead, long-tailed, harsh-voiced, Red, Blue and Yellow Macaws, flew in pairs or small flocks, interrupted in their feeding, or love making, by the put! put! put! of our tow boat. Yellow-naped Amazon Parrots, a pure white Cotinga, and birds of many and gorgeous colors, claimed our attention as we wound our way around the many bends of this swiftly-flowing tropical river. Distance is known not in miles, but in the number of bends, for there are, I am told, over three hundred of them between Tunky and the Banbana mouth.

Ten o'clock that evening found us at the foot of the Walpatara Rapids, the longest and most difficult at all seasons of the year on this river, and here we tied up for the night.

With the first peep of day a rope four or five hundred feet long was taken ahead by the Indians and attached to a windlass near the head of the rapids, the other end to the bow of our pitpan, as we were to be the first to go up. Four Indians manned the windlass and the rest of the crew, each with a long sharpened pole, took their stands on either side of our pitpan, all stripped to the waist. Thrusting the sharp points of the poles into the crevices of the rock bottom, and with a yell, the Indians threw their weight upon the poles, and we started moving into the rapids. Keeping a course as near the bank as possible in order to take advantage of the shallow water and least amount of current, we could hear the click of the poles against the rocky bottom as slowly but surely we were forced through the roaring torrent. Up, up we went, the boys at the windlass winding taut the rope, holding every inch gained by the polers, yelling and chirping as they strained against the poles in unison. Now we grounded upon a rock, a poler changed his place to lighten that side, we were off, shipping some water as we reached a particularly turbulent spot, but on we went. Just ahead was an exceedingly rough spot, where the water boiled and roared over large hidden rocks; we reached it and water dashed into the boat, and we wondered if enough to harm our equipment. With a shout the Indians strained at the poles as the sweat streamed from the taut muscles of their brown backs and arms. More sweating and straining at the poles as we were forced slowly through the last stretch of turbulent waters; then with a lusty shout in which we joined we glided smoothly into the quiet waters, above. We tied up to the bank, the water was bailed out of our boat, and the Indians went to bring up the next one. The tow boat was the last to come up; drawing more water and heavier, it was a greater strain upon the Indians. The Moskitos are without doubt wonderful boatmen and endowed with great strength and endurance. All three boats were now above the rapids and lashed to the tow boat we proceeded up stream, while we ate breakfast. Two more rapids were encountered in the next three hours, but as they were neither as long, nor as turbulent as Walpa-tara, the windlass was not used; we were poled up again singly.

We reached Santa Rosita at eleven o'clock and Tunky at four, a village of thirty or forty houses, most of them vacant, two or three stores and the bodega, or warehouse, of the Tunky Transportation

Company, where we spent the night. After an early breakfast, we embarked in Mr. Miller's pitpan at half-past six for the last leg of our river journey, seventeen miles up the Tunky to Miranda. The baggage in two small pitpans left long before daylight, as the tow boat and our large pitpan were to remain at Tunky, while we were to be poled up, as the river was too shallow even for the use of paddles. This was a day of exceedingly hard work for the Indians, many swift shallow rapids, outcropping rocks and very low water were encountered; we were aground almost continuously. In many long stretches there was not enough water to force the boat ahead with poles, and the Indians were compelled to get overboard and drag it across the rocks. Except for the shallow water and the hard work of our Indians it was a beautiful trip, with great trees on either bank whose branches met over our heads, clumps of bamboo, palms, and tree ferns.

Settlements of the Sumo Indians with their open-sided palm-thatched huts, always at the foot of a small rapid and the ever present Supa Palm growing near by. Sumo women washing clothes and beating them on a flat rock; children on the bank answering the bickering of our Indians,—for the Moskito Indian believes he owns the Sumo, body and soul, usually taking what he wants as he passes by. A pair of beautiful Sun Bitterns kept just ahead of us, flying from rock to rock and uttering a harsh cry from time to time, always keeping just out of range until they finally disappeared into a tangle of wild cane.

Sun Grebes were seen swimming amongst the foam in an eddy at the foot of a rapid; as we came nearer they would fly to the lower limbs of a tree hoping to escape our notice; then at the grinding of the boat on the rocks they would take flight and disappear around a bend in the river to repeat the performance later. A troupe of twenty-five or more Mantled Howler Monkeys made the forest echo with their weird harsh howling As we rounded a bend in the river at three o'clock in the afternoon, we saw the wharf at Miranda, perched high on the left bank, well out of each of the floods that sweep down all tropical rivers in the wet season. Here Mr. Davey, temporarily in charge of the Eden Mine, loaded us all on top of the baggage on a small flat car, and a very efficient gasoline locomotive hauled us seven miles over the only railroad in eastern Nicaragua to Eden, where we were to make our headquarters. A few minutes

UPPER.—Sumo Indian House, Tunky River.
LOWER.—Native Banana Plantation, Eden.

after our arrival we were greeted by the first rain since we left Bluefields. We had had five consecutive days and nights without rain, and we were not to see such a dry spell as this again in the three months following.

The little mining town of Eden is situated on the eastern side of a range of mountains, 1500 to 2500 feet in height, in the center of what is known as the Pis Pis Mining District.

All of the surrounding mines were closed down during our stay, the Eden Mine only producing gold. The town built entirely by the Mining Company, is a model up-to-date plant including hydro-electric plant, cyanide mill, machine shop, saw mill, ice plant, a well-stocked store, staff house, and other necessities in a tropical mining community. The staff house, a two-story frame building in the shape of a U, with porches extending around the entire building on both floors, supplied extremely comfortable living quarters for twenty-five or thirty persons. We occupied a large second-story room on the north corner and every thing possible was done for our comfort. From the porch at an elevaton of 700 feet, we had a fine view of the surrounding mountains and cleared patrero, with its grazing cattle, fattening for beef. The porch in front of our room answered admirably for our workshop, where we skinned and made-up our specimens in the daytime, while at night we worked in our room amply supplied with electric lights. Electric lights were hung at regular intervals on both porches and in the basement, two sides of which were open. These lights at night attracted great quantities of insects of every description, affording a wonderful opportunity to collect many rare forms that otherwise we would not have found. By hanging sheets of white cheesecloth behind some of these lights, several thousand night flying Lepidoptera were added to the Academy's collection.

Field work began at six in the morning, with a tramp into the surrounding forest to collect birds and mammals, returning about eleven for a shower bath and lunch. The afternoon, and generally until eleven or twelve at night, was taken up in skinning and making-up the specimens secured in the morning, for in this hot damp climate they spoiled very quickly. The forest round about Eden was extremely difficult to get through as the heavy undergrowth matted and tangled, formed a barrier no one could penetrate without first cutting a trail. The immense buttresses of the

larger trees, fallen and rotting giants covered with parasitic plants, with lianas three inches in diameter to the size of small wires, trailing the ground from the higher limbs of the trees and the slippery soil under all, made successful snares that only too often brought us to earth with a realization of their hidden powers. Trails there were in many directions and these we followed in much of our hunting, but upon shooting a bird another trail must be cut in order to retrieve it and more than once did I have to call Henry, our faithful Indian boy, to cut me out when I had all but secured a fallen specimen. Henry with his machete, that indispensable daily companion of the Central American Indian, was with us always and served us well. The hills, the valleys, the streams and the clearings were scoured and combed, yielding daily their quota of birds, beats, and insects to the collection. Fish were collected in all of the streams encountered, either with a small mesh seine that we took for the purpose, or by exploding dynamite in the deeper holes and eddys. Three species of freshwater fish new to science were thus secured. Many specimens of reptiles were shot during the daytime; and at night, others attracted by the use of electric torches or acetylene lamps, were caught in butterfly nets. and all were preserved entire in formaldehyde.

Eastern Nicaragua like all tropical-forest countries has a wet and a dry season, March, April and most of May constitute the so-called dry season, while the balance of the year is given over to the wet. The Eden Mining Company has for a number of years kept a careful record of precipitation and finds the average rainfall for the year to be 145 inches. The daily temperature varies between 80 and 95 degrees in the shade, but in the sun it is very much higher; at night it is generally cool enough to require a thin blanket. Hardly a day passed that we did not have showers, sometimes almost continuous, with here and there a dash of sunshine, yet this was the dry season. Our clothing while in the bush was nearly always wet, either from the heavy showers or from perspiration due to the steamy heat. This excessively damp atmosphere made the drying of bird and mammal skins and the preserving of insects, a painstaking operation, for a humming-bird skin that would be fairly dry in two or three days here at home, would show very little signs of drying in two weeks at Eden. A supply of very light wooden trays, knocked down, to be put together in a few minutes,

were taken in our equipment. The skins as made up were laid in these trays, plentifully dusted with powdered naphthaline to prevent mould and keep out the ever-present ants and cockroaches. Between showers they were arranged on the porch in the sun, shaded from its direct rays by cheesecloth and when a shower came up, which was often, they were hurried into our room to be brought out again as the sun appeared. At night they occupied every available spot in the room. Moths, butterflies and other insects were dried in a much simpler manner. A large box-like closet with shelves and a 75 watt electric light at the bottom, served as a drying cabinet. The specimens placed between layers of cotton, or inpaper folders in tin canisters with plenty of naphtha flakes, were dried by the heat from the electric light, then sealed with adhesive tape to keep them dry and keep out ants. While the drying and preserving of specimens occupied much of our time, it was simple compared with what we would have found necessary had we lived in a tent or thatched hut, which is often the lot of collectors in the tropics.

On the eleventh of April we made a trip by pitpan down the river to Santa Rosita, where we spent a week collecting birds quite different from those found at Eden. Here we saw for the first time numbers of *Ibicter americana*, an exceedingly noisy species of Caracara. It is called by the natives Ka-Ka-Ka-Ka from the harsh call of the birds. Seven of these Caracaras were perched upon the ridge pole of the thatched roof of a Sumo house vieing with each other for vocal supremacy. The crops of those that we collected were gorged with wasps. Here also we found a pair of Nun Birds, their bright red bill, with a white ruff of feathers at its base, giving a queer effect to the sombre grayish-black body. Numerous other species were found here only. Making our headquarters in the abandoned and partly tumbled down office building, we had a good place to work and a dry bed to sleep in. It was here only that we were bothered by mosquitoes while in Nicaragua. About half-an-hour before sunset they came out in swarms, driving us to our beds under the mosquito nets, and preventing any work in the evenings. They were also very numerous in the forest during the day, keeping us continually on our guard.

One night was spent drifting down the Banbana River with a jack-light in search of Tapirs and other night-prowling animals.

While we heard Tapirs breaking through the bamboo several times, they failed to appear for their bath. A full moon came up about midnight, silhouetting the long slim bamboos over our heads against its silvery light making them look like giant ostrich plumes, as they waved and glistened in the gentle tropical breeze. Such a night of enchanting beauty fully repaid the disappointment in not seeing a Tapir. Mr. Street did, however, collect one on his homeward trip to the coast in May.

Shortly after our return from Santa Rosita we made a trip across the mountains from Eden to the Great Falls Power Plant that furnished electricity for the mining operation.

This time we travelled the eight or ten miles on mule back, taking the greater part of a day for the journey. Trails, or roads, in this part of Nicaragua are very bad even during the dry season, making progress extremely slow. Owing to the great amount of rain, and the soft nature of the soil, they are worn into deep holes or ruts, known as bull hummocks, giving a washboard effect. These bull hummocks are caused by the oxen or mules stepping in the same place each time and wearing deep gullies, the ground between the gullies standing in high ridges. Much of the time the gullies are full of water, causing the mule to flounder down to its knees, the ridge often touching its belly. Frequently as the mules splashed through the hummocks, my feet would touch the ridges, and one can easily imagine what mud-bespattered objects we were upon reaching our destination. I cannot pay too high a tribute to the surefootedness of the mules, for they kept their feet on the steep slippery hillsides, jumping over fallen trees across the trail, wallowing in mud-filled holes belly deep, or slowly picked their way along a slippery loose-rocked ledge.

Mr. J. S. McKenzie, electrician in charge, accompanied us and acted as our host the week we spent at the Falls, and as his spare time permitted, joined us in our hunting, assisted in the skinning of mammals or collected insects at night around the lights, thus rendering valuable aid in our work.

We lived in the comfortable quarters erected for Mr. McKenzie, on the hillside overlooking the Pis Pis River, which flows into the Waspuc, thence into the Wanks, finally discharging its waters into the Caribbean at Cabo Gracias á Dios. Collecting along the river and on the surrounding hills netted us many species of birds new

Supa Palm (*Guilielma utilis*).

Orchid Covered Tree, Pis Pis River.

to our collection; in fact not a day passed here without adding four or five species not previously taken to our list. Several months could easily have been spent in this section and, even then we would not have taken representatives of all the species either resident or passing through the forest in waves. The bird population was here more numerous, both in species and individuals, than at any other spot we visited.

The Tinamous or Mountain Hens, as they are locally called, were often heard in the surrounding bush especially about six o'clock in the evening,—hence the name Six-o'Clock Bird, a common venacular. Extremely shy, and hard to distinguish from the ground of the forest in their olive-brown plumage but we never-the-less succeeded in collecting a fine series of them. A large colony of Wagler's Oropendolas decorated four large trees in front of our door with their nests, until they looked like huge Christmas trees. There were over one hundred pairs of these birds in the colony; they were extremely tame, and we were very careful not to disturb them by shooting near the nesting trees. Several fine mammals, including a Nasua, a Rabbit, and fine pair of Mantled-Howler Monkeys were obtained. On our way back to Eden a Tamandua, a small form of Anteater, was shot from a high tree while in the act of eating termites from a large nest.

Owing to the press of business, Mr. Street was compelled to return home the first of May. I remained at Eden continuing the work, with another short visit to the Falls, until June fifth. Early in May, a large band of Mantled Howler Monkeys visited the forest above the Staff House, making the hills echo with their weird cries. The collection needed Howlers, and suffice it to say twelve fine specimens were obtained, fathers, mothers, and babes-in-arms, enough for a group and a series for the study collection, including skulls of all and entire skeletons of several. The skinning, curing the skins, and roughing out the skulls and skeletons of twelve large monkeys in a hot climate, is a continuous and towards the end none too pleasant job, especially to the olfactory nerves. The smaller mammal skins were made up on the spot into study skins; the larger ones were cured with salt and packed in a barrel between layers of salt, as I found it impossible to get the skins dry in such a moisture-saturated atmosphere. With the approach of the rainy season, the heavier and more frequent showers turned

the already muddy trails into almost knee-deep mires, making walking extremely slow and tiring. The greatest difficulty was to keep the specimens and butterfly net dry in the field, even after wrapping them in a rubber poncho; by the time I reached the Staff House the birds looked as if they had been fished from a creek.

From the middle of May collecting was carried on in almost a continual downpour, with hardly any sun at all to dry the specimens, so that I discontinued field work the 24th of May, and started to pack up the collection. This was by no means an easy task for they were to travel over 2500 miles, most of it more or less exposed to the rain and certainly in great danger from ants and cockroaches that at all times infest banana-carrying steamers. I was fortunate in securing a good supply of large square tin boxes, with tight-fitting circular lids, used to ship dynamite to the mine. A handful of naphthaline in each tin, to keep out insects and prevent mould, and the tin enclosed in a wooden box, brought the specimens home in perfect condition.

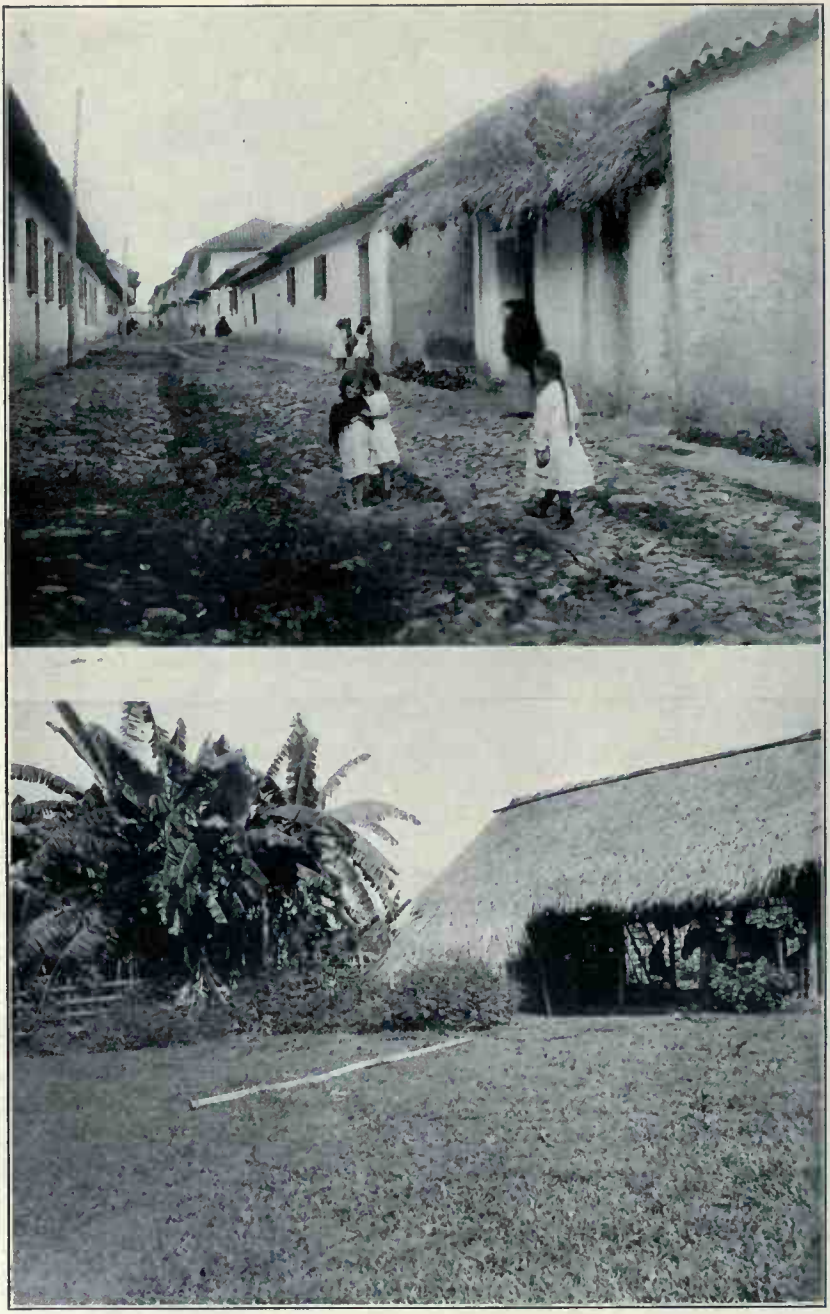
On June 5th, at seven o'clock in the morning, I bid good bye to my companions at the Staff House, whose pleasant companionship will always be remembered. The collection and equipment were loaded on a flat-car and covered with a tarpaulin and Dr. Bouchelle and I crawled on top with a number of employees. Henry, the Indian boy, was there too as he was going home to Sandy Bay, on the coast between Prinzapolka and Cabo Gracias á Dios.

As we left Eden it rained, almost continuously for two days and nights. Arriving at Miranda, the baggage was loaded into three pitpans and covered with tarpaulins.

At Miranda, I left Dr. Bouchelle, knowing that I should welcome him in Philadelphia before the end of the year.

What we accomplished in Nicaragua was due entirely to Dr. Bouchelle; ever watchful of our health, our comfort and the thousand-and-one things that go to make an expedition a success in the field.

There being now plenty of water in the river, the crew of Sumo Indians made good time with the paddles. Although it rained continuously, I stopped at the three Sumo settlements to take pictures, with very fair success. Arriving at Tunky, the baggage was transferred to a fifty-foot pitpan with a crew of seven Moskito



UPPER.—A Street in an Upland Town, with Children of the Chibcha Indians,—Zapaquira, near Bogotá.

LOWER.—Ranch-house and Grove of Plantains on the Plains of the Meta near Villavicencio.

In the footnote on page 15 of this report the names of Mr. Ellsworth P. Killip of the United States National Museum and Dr. Tracy E. Hazen of Columbia University, the other members of the party, are inadvertently omitted.

Indians, I crawled under the tarpaulin, and we were off. The Banbana River was partly in flood, so we made fast time under the six paddles, passing through the Walpa-tara Rapids at nine o'clock that night during an unusually heavy downpour of rain. The river gained in flood as we neared the Banbana mouth, and so did the rain, keeping the Indians bailing frequently to prevent the water reaching my bed and baggage. I was not at all loath to leave the pitpan at eight o'clock on the morning of the 7th and see my baggage put in the warehouse at Prinzapolka.

The Schooner "Star" put in on the 12th and took me to Bluefields, whence on the 18th I sailed for New Orleans.

We had collected mammals representing about twenty species; six hundred and twenty-five birds representing over two hundred species, two or three apparently new to science, together with twenty-six sets of eggs with their nests, about a thousand specimens of fish and reptiles, and some seven thousand insects.

THROUGH THE ANDES OF WESTERN COLOMBIA*

By Francis W. Pennell.

Travellers, especially botanists, could not ask for a finer introduction to any country than is afforded by the railroad ride from Buenaventura on the Pacific coast of Colombia to La Cumbré, near the summit of the western Andes. The succession of scenery, from the near and intimate view of the Tropical forest with its richness of detail, on through the gorge of the Dagua River and up to an elevation where the eye obtains a vast view of the summits of two Andean cordilleras, affords most remarkable and beautiful contrasts. The change in plant life from the shore and the heavily-wooded lowland to arid slopes, with distant views of prairie or mountain forests, is as botanically interesting as it is fascinating. There were three of us taking this ride one morning in early May, 1922. We were entering Colombia for the purpose of botanical collecting

* Account of an expedition for botanical exploration undertaken jointly on behalf of The New York Botanical Garden, Gray Herbarium of Harvard University, United States National Museum, and the Academy of Natural Sciences of Philadelphia. The party consisted of Dr. Francis W. Pennell of the Academy of Natural Sciences of Philadelphia, and Mrs. Pennell.

and exploration in the Central and Western Cordilleras of the Andes.

The train passed first across the mangrove marshes which skirt for many miles the western shore of Colombia, forming a uniform ribbon of dull green. Then passing inland and slightly upward, we entered the most luxuriant of tropical forests. Along the Pacific coast from Panama to Ecuador, this forest covers the lower slopes of the Western Andes, there catching the winds from the ocean and receiving the heaviest rainfall of the New World. Vegetation is rank, and the flora contains a high proportion of plants belonging to families which prefer humid warmth. Wild bananas and their relatives abound, as do the massive herbs and succulent climbers of the Aroid family. Bamboos and palms are common. Back in the forest, tree-growth is so dense that little light breaks through. There is a great variety of trees in a tropical forest but little bloom is seen, so that the forest, for all its exuberant wealth of foliage, is decidedly sombre. Along the river course, and through the gorge of the Dagua, we saw most attractively the lowland tropical forest.

Less than a score of miles from the wettest phase of this forest, above the curving gorge of the Dagua River and in a pocket, so placed that the winds from the Pacific have been previously intercepted by the first outlying ridge of the Andes, we entered an open grass-covered valley, so dry as to inhibit any growth of forest. As the train wound its way between the steep slopes we could see each stage of the transition. Below the gorge were giant Aroids, their leaves as massive as the well-known "elephant-ears"; above the gorge were giant leafless Cacti. Shrubs with silvery or yellowish leaves were typical of the upper Dagua valley.

At the town of Dagua, in the open valley, the train left the river and wound its way upward, curve upon curve. The upper grasslands into which we entered had at this time numerous flowers,—and very beautiful were the various species of ground orchids with their clusters of yellow, orange, or red flowers. Where rain is seasonal there will always be a time of beautiful bloom.

The town of La Cumbré, where we made our first collecting base, is situated near the summit of the Western Andes. Here we could descend to open tropical slopes, or ascend into the subtropical forest. This forest of the mountains is far richer in air-plants than is that

of the lowlands. The cup-like Bromeliads and the endless variety of epiphytic orchids form a rich world of life in themselves. We spent only three weeks at La Cumbré, although indeed the whole five months of our stay in Colombia could have been well spent obtaining the flora accessible at that station. However, our mission to collect and compare the floras of the upper zones of life of the Central and Western Andes, called us to go further inland and to higher levels. The Western Cordillera near La Cumbré rises from the tropical into the subtropical zone of life, but still higher occur two other life zones, the temperate or cool zone, and the paramo or cold zone.

To reach these the upper slopes of both the central and western Andes was possible from the deep intervening trough of the valley of the Cauca River. Before we descend to this valley from the western range, let us pause and see one of the most famous Andean views. On either side, north or south, the Western Cordillera rises far-away to heights much greater than our low pass; before us is the open, floor-like, yellowish-green Cauca valley, the course of the river showing as a winding silver thread; across the valley, some fifty miles away, the foothills of the Central Cordillera rise sharply, their bases bare but, just above, their flanks sheathed and coated with deep green forest. Perhaps we see these hills soon passing into cloud, or we may have the good fortune to see them dwarfed and grouped at the foot of the great mass of the Central Andes, the high chain that, as a rampart reaching repeatedly to snow, cleaves Western Colombia from south to north. The Western and eastern Cordilleras in Colombia rise here and there to like altitudes; but neither maintains the height of the Central Cordillera.

Away from this entering railroad there are not even roadways by which to reach the cordillera, so that the problem of arranging for transportation is the first which must be considered. Our first expedition into the Cauca valley resulted in the purchase of a riding mule for each of our party and four for cargo. These were procured in the neighborhood of "La Manuelita," the estate of Sr. Henry Eder from whom Dr. Chapman's ornithological helpers had received such courteous aid. We left Cali, a thriving town with a modern atmosphere, and after a few hours by train to the end of the present railway at Aganche, changed to our mules and spent three days of leisurely travel journeying to Popayán.

We all needed to become accustomed to the saddle and to the individual personalities of our mules. A good mule soon becomes a docile helper to a plant collector, permitting him to ride to the side of the trail or into bushes after flowers. But there is a Colombian saying that "a mule will be always a mule," and a few thrilling occasions leave intact my belief that our beasts were genuine mules.

We rode into hills covered with a chaparral shrub growth, and where the gorgeous "flor de Mayo" (flower of May), made an unforgetable impression. This Colombian favorite, of the tropical family of Melastomads, is a bush or small tree with large flowers, the petals of which are on opening a glorious pink-purple but later change to a deep violet. Nearer Popayán and in the same arid phase of the subtropical life-zone we saw our first oaks. These are stately trees, with glossy leaves that in form suggest a shingle or a narrow-leaved chestnut oak. On my earlier expedition to Colombia, which had taken me from the tropical lowland to above timber line on all three cordilleras of the Andes, I had come to consider that the Colombian oak was the surest indicator of the arid subtropical zone. Throughout the present trip it was found as consistently at this elevation and constantly denoted a dry-life phase of this zone of life.

Placed in the subtropical zone of life, Popayán has a delightful temperature the year round,—the temperature we associate with late May, or early June. Fever-carrying insects and tropical plagues cease with the true tropical lowland, and in a climate without any winter there seems to be no menace to health. The city is beautifully situated at the base of the foothills of the Central Andes, with a clear view across the valley westward to the ridge of the Western Andes, rising to Santa Ana and Cerro Munchique. Behind and above the city, in the Central Andes, is the snow-covered summit of Puracé, an almost continually smoking volcano. As should be expected from such an environment, Popayán is one of the most interesting of Spanish-American cities. Dating from 1536, founded by Belalcázar on his journey north from Quito in search of "El Dorado," it has been throughout its history a chief governing and intellectual center of Colombia. Our residence there of more than six weeks,—our home, as guests of the Department of the Cauca, in an ancient and now abandoned Spanish convent—gave

us the privilege of sharing in the social life of the city and of realizing its many choice features. Popayàn was the home of Caldas, the scientist and patriot martyr of the wars of independence, and later of the botanist Lehmann, German Consul and enthusiastic explorer. Indeed, our interest in Popayán, beyond the desire to study from so favorable a point of access the vegetation of the cordilleras, lay in the desire to collect for North American herbaria the many species of Lehmann's, previously known only from specimens that had gone to Europe.

We reached both the Central and Western Cordilleras from Popayán. The latter brought us into the most abundant orchid life that I had ever seen; but the former took us to the higher altitudes which were more properly the goal of our expedition. As guest of Dr. Julian Uribe Uribe, we visited his cottage on the slopes of Puracé, and from there climbed over the ash-covered paramo to the volcano's crater, and as guests of Sr. Ignacio Muñoz we visited the delightful hill estate of San Isidro, and thence went up to his cool forest ranch of Calaguala, and to the paramo summer cottage of Paletará.

As one leaves the city and climbs the hillsides east of Popayán, the open or shrub-covered slopes give way but slowly to the cool highland forest, forming the zone which has been called temperate, not only from its mild temperature, but also because of the occurrence at this elevation of so many forms of life characteristic of the far-away north and south temperate zones. With Melastomads, Rubiads and such tropical groups, one finds species of buttercups, geraniums, chickweeds, and groups familiar to us in the northern United States and Canada. A traveler from Argentina or Chile would have found even more that was familiar as calceolarias, fuchsias, and nasturtions grow in this cool zone, northward, high in the Colombian cordilleras, and southward descending to sea-level. The unraveling of the elements of the flora of the temperate and paramo zones of the northern Andes, explaining their origins, and the critical comparing of this life upon different cordilleras and isolated ranges, offer a most attractive problem both for botany and geography.

But in the challenge to the mind offered by the composition of this flora, we must not lose the actual picture of the temperate forest as we saw it at Calaguala, above Popayán. I have seen the tem-

perate zone in many localities in Colombia, but my most vivid impression of it is this forest at Calaguala. Never have I seen tree limbs so heavily laden with air-plants; never have I seen the forest in a more perfect setting. The temperate forest has not the tumultuous riot of species that characterizes the tropical and subtropical zones; and the same species will recur in sufficient abundance to give character to a vista. Look from the hill above Calaguala eastward into the forest. The trees appear as in a park, and one discovers with surprise that this appearance is due to the forest having been actually cleared for pasturage. Only the undergrowth has been cleared and the forest floor planted to shade-loving grasses. Every forest tree remains in its proper beauty, and the great green trees with their wide branches form a magnificent scene in themselves. Contrasting color is given by the load of air-life which the branches bear, especially by the rich purple maroon of the upright cups of a certain Bromeliad. Delicacy and a certain mystery are added by the tints of pale yellow-green, given by the slender pendent growths of an air-lichen. Beyond, behind, and on above the forest, forming a background as majestic as beautiful, lie greenish-brown fields of grass reaching up to snow. Such a background to such a forest is incomparable.

Paletará is only a few hours from Calaguala, and the summer cottage of Senor Muñoz is placed above the swift brown current of the Cauca River, here near its source. Paletará is actually a broad meadow, some ten miles or more across, enclosed among hills and appearing to have been once a lake. On all sides it is surrounded by forest, and yet its vegetation is true paramo. One goes *down* from the forested hills into a prairie filled with plants which normally grow only *above* timber-line. This anomaly occurs elsewhere in similar ancient lake basins of this mountain-mass, although only at elevations nearly up to true paramo. I suppose that the explanation of this distribution must be that the open sweep of miles of prairies gives opportunity for winds so driving as to inhibit tree growth. Later in the expedition, I saw shrubs and small trees growing on steep banks almost up to the snow itself.

Paletará was our nearest approach to the equator, about two degrees north latitude, yet never have I felt more chilled than during the three days of our stay. In constant driving rain and fog,—"paramo" such weather is called, with a temperature of 35 degrees

UPPER.—A Palm in the Tropical Forest at Villavicencio, Meta.
LOWER.—A Meadow of "Frailejones," *Espeletia*, on the Paramo de Cruz Verde, in the Eastern Andes near Bogotá.

Fahrenheit, and in a cottage unadapted to winter, one would be chilled enough. Our few days must be all used, and so each day I went out over the paramo moor and once up through the forest and shrub fringe to the edge of true mountain paramo itself. Every excursion was amply successful, although after each trip half the night was needed to separate from a soaking cold mass of vegetation the minute paramo species.

Just as there are fewer kinds of plants, trees, herbs, or air-plants, in the temperate zone than in the zones below, so here on the paramo one finds a yet more impoverished flora. The plants are herbs or low bushes. There are many grasses, sedges and rushes, and along the streams the aspect is that of far northern moors; but certain peculiar plants give the uplands a character very distinctive character.

The most characteristic plant of the Colombian paramos throughout the various highlands of the Andes is the "frailejon," *Espeletia*, a cycad-like plant whose woody stem, clothed with the dead leaves of former seasons, bears at the summit the leaves of the present year, with the flower clusters of small sunflower-like heads. The plant,—stem, leaves, flower stalks and heads of flower—is densely clothed with soft hairs. Each isolated region of paramo appears to have developed its peculiar "frailejones," and the species of Paletará was not the species seen later in the northern portion of the Central Andes. Probably, could we know all the species of "frailejones," where they occur, and how they are interrelated, the information rightly interpreted would go far toward reconstructing the course of recent geologic history in the northern Andes.

"Frailejones" are large and stout and are well coated with protective wool. More numerous in kinds are the paramo plants which are dwarfed to a simple rosette tuft of leaves, or have the stem short and prostrate against the soil. We found gentians of tiniest size, yet each a star of finest blue; there were small Lupines; and minute dandelion-like plants, with a circle of leaves, just peeping from beneath the rim of the single head of flowers. But to the paramo and its life, reaching even higher altitudes and touching snow, we were to return when in the Quindio.

On the 12th of July, we left Popayàn for the journey to Cali, from which city my wife returned via Buenaventura and Panamá to the

United States, while Dr. Tracy E. Hazen, of Columbia University, joined Mr. Killip and myself for the journey into the Quindio.

The northern Central Andes, locally known as the Quindio, afforded an excellent opportunity to study the distribution and composition of the flora of the high Andes.

We proceeded down the Cauca River by steamboat from Cali to the little port of Zarzál. There our mules were waiting and we started at once eastward to Armenia and Salento. The route to Armenia lay across the tropical valley of the Cauca and was chiefly memorable for the vast groves of bamboos seen. Indeed, a band of vegetation just below the base of the cordillera must have been originally one almost solid growth of bamboo, forty or fifty feet in height. There were also many palms.

At Salento, a small town on the middle western slopes of the Central Andes, we rented a house surprisingly adapted to our needs. From this base, excursions were made into the surrounding forest, but our chief interest again took us to higher levels. Mr. Killip and Dr. Hazen took the journey over the historic old Quindio trail, returning via the new graded trail recently built by the government, some miles south of the old course. Mr. Killip spent some days in the capitol of Colombia, Bogotá, a city well known to me through three months' residence in 1917. So in August I went, by invitation of Sr. Alfonso Tobón, nephew of the President of Colombia, to his mountain estate of "Alaska," where I was soon joined by Dr. Hazen.

"Alaska" deserves its name. The estate is placed high on the side of the Cordillera, and the ruthless methods of Sr. Tobón's predecessors have changed a region originally covered with most beautiful forest into a bleak desolation. In order to form pasturage every vestige of forest has been cleared, the scrub cut, and old logs burned. One wonders how many years will go by before Colombians regret heartily a policy of utter forest destruction. It seems pitiful, too, to see with what zeal settlers in the virgin beauty of a forest loaded with luxuriant epiphytes, will plant the Australian *Eucalyptus*, a tree whose gray-blue foliage and bare branches seem better fitted to city streets.

We wished to go above "Alaska," so, by the planning of Sr. Tobón and with a small party of his friends, Dr. Hazen and I went up for several days of camping on the paramo. We were

conducted to a valley just below the snow on the Paramo del Quindio, the peak whose name has also been adopted for the whole group of these mountains. Here camp was placed in the midst of the beautiful alpine "frailejones." We piled the leaves of the "frailejones" over the floor, thus forming a deep, soft, aromatically fragrant mattress, and the stems covered with old leaves we placed behind our tent to form a most effcient wind-break. Having secured every side of the tent in this manner, we were comfortably warm although the temperature each night was freezing on the paramo, and one night snow fell.

I had once before been on Ruiz, another peak of the Quindio group some forty miles north of our present base, so I knew what would be some of our trophies on the paramo here. The golden "frailejon" is the largest species of *Espeletia* known to me, and its massive stems, sometimes eight or ten feet tall, when grouped, form groves of a strange peculiar majesty. The leaves are clothed with soft wooly hairs, silvery or golden-yellow; indeed, the richest hue of gold that I have ever seen is that of the hairs of certain of these " frailejon " leaves. Other plants, conspicuously clothed with wooly coats, were a species of lupine, with long, very white hairs and, covered with the densest and most felt-like hair coat that I have ever seen on any plant and the white " frailejon," a species of *Culcitium*, another genus of the sunflower family. All plants of the paramo must withstand cold, and accordingly we find developed various interesting means of protection. A wooly coat of hairs is the simplest. A low growth along the ground is a frequent adaptation, many plants growing in wide cushions from which only leaves or short flower shoots ascend an inch, or a fraction of an inch, into the air. A species of lupine grew matted on the ground; but denser colonies were formed by an alpine plantain and by certain Composites and Monocotyledons. One of the last, growing at the edge of pools in the valley's head, forms rounded coralline cushions of almost rock-like hardness and with outline as precise as any pattern. Although its short leaves projected vertically and one walked on the leaf-tips, these were so rigid and strong that no impress from the human foot could be detected.

We collected as full a series as possible of these alpine plants, and it is believed that by combining the result of this visit with that of the previous visit to Ruiz, our herbaria have now a fair repre-

sentation of the paramo life of the northern central Andes. We were unable to give as much time as we had hoped to the flora of the temperate forest just beneath this, but here again the two expeditions supplement each other.

On our descent from the Quindio in latc August, Dr. Hazen had to return promptly to New York for his college work. Mr. Killip being desirous of collecting again at La Cumbré, in order to obtain many orchids seen by us in May only in leaf, accompanied Dr. Hazen to that convenient and attractive center.

With a capable peon, and with a reduced outfit of four cargo mules, I visited first Manizales, the seat of government for the Department of Caldas. From this city we proceeded directly westward to the high portion of the Western Andes which is a landmark from very far. The chain seems to rise suddenly to form a flat table, actually the short but high ridge of the Cerro Tatama. Although from the Cauca valley and from Santuario the highland appears wooded to the summit, I had reliable information that the upper slopes would be true paramo.

I was most hospitably received at Santuario, and I had no difficulty in arranging for a guide to the paramo. There was danger of oncoming rains, although as yet the weather was good. So I arranged to make a quick journey to the mountain paramos, allowing two days there. From a previous experience, when I had climbed to the Paramo de Chaquiro, one of the northernmost summits of the Western Andes, discovering it to be a paramo with a uniform and rather meagre flora, I believed that two days would allow sufficient time. Beside the danger of the September rains I was influenced by the reported difficulty of carrying up provisions for any stay of length.

So with two helpers I started into the forest from the cottage of Sr. Campia, situated in the subtropical forest on the lower slopes of the cordillera. My guide thought that we might be up in a day, and certainly in a day and another morning. We could see our goal, full before us in a dark-green line of cliffs, not twenty miles away. The "trail" proved to be only an old cut path over which no one had traveled for eighteen months! It was well that I had taken the best guide obtainable in the village. He had been over the way, but his mode of progress was not the northern guide's observation of landmarks. Rather, like a hound on the scent, he

progressed almost feeling his way, by hunting for old cuttings of the machete.

Our course lay first up a valley, following the guide's lead through a dense subtropical forest. Here there was no especial difficulty although progress was not swift. Then we reached a narrower part of the valley, and, after passing the night in an unfinished house in a small clearing,—the only sign of human occupation seen during our entire ascent,—we went on up along a turbulent mountain brook. So closely did we follow this stream's course that at times we made its very bed our route, and advanced by wading. We crossed its course in all twenty-five times, fording usually in the shallow formed by hard rocks at the head of rapids and waterfalls. At last we had to leave its course at a point where ahead we could see much higher waterfalls with no possibility of ascent.

From the river we went up the side of a valley so steep that it seemed to me impossible that the men could carry the loads. Slowly feeling our way, crossing logs and swinging upward by projecting tree-buttresses and roots, we could realize the amount of our advance. Every moment the view became wider and wilder. We passed just above the brink of a waterfall of unknown height; it was certainly great, but it was too perilous to attempt to reach any point with an adequate view below. Across the valley were two streams falling in sheer cascades, while ahead the chief stream of the valley could be traced through a succession of high waterfalls. We could look up to the cliffs now seeming quite near, but a uniform green still suggested only forest or shrubs to the highest point in sight.

We had meant to place our camp beside water in a little valley near paramo known to the guide. From the hillside forest we were working our way toward sundown along a spur, following the guide's amazing scent over and under the age-rotted logs and mossy tangles that I markd as the temperate virgin forest. But, alas, we came into a thicket of *Chusquea*, the dense growing bamboo that forms great tangles at this elevation. A bamboo grows rapidly and is liked by bears. The guide could find scarcely any old marks, and time after time his supposed cuttings proved on close inspection to be cut stalks broken by bears. Night came upon us here, and in the bamboo thicket, without water, we were forced to pitch our tent. We made what supper we could and hoped for quicker advance on

the morrow. That night, the eighth of the month, the first September rain fell,—a thunderstorm that chilled us on that high ridge.

The next morning we started at daybreak; but it proved a matter of over three hours to advance a few rods through that thicket. The cliffs ahead were too precipitous for us to assume that we could reach our goal by any but the known route. Now, within a mile or so we could see the cliffs,—an hour's clear progress would have brought us to them; yet it required hours of cutting through tangle, scrambling up cliffs, and feeling our way through virgin forest such as that of the previous day, to bring us at last, in the early afternoon, to the paramo.

After passing through a narrow belt of shrubs we came out on open grassy paramo, although still above us rose cliffs, deep-green with a coat of small trees and bushes. Indeed, I was not to reach the summit of these, and so to look beyond at the higher elevations of Tatamá. Lack of provisions, and the certainty of rain, meant our return on the morrow; and for this day the curtailing of our time on the paramo to two hours and a half. Perhaps, had the flora been so meagre as that of Chaquiro, even this little time might have sufficed, but on the paramo of Tatamá the flora proved exceedingly rich. Seldom have I found at such elevations a greater variety of plants; never a variety more interesting. Even photography had to be put aside in order to use every moment in gathering the plants before me.

From an advance survey it was natural to expect only slight difference in the kinds of plants growing upon isolated portions of the same chain as near together as are Chaquiro and Cerro Tatamá. Experience elsewhere had taught me to expect some divergence, but I was wholly unprepared for the great difference between the plant-life of these two summits. Except among plants with special means of dispersal by wind, I found little in common in the upper zones of life. Climbing to either highland one passes from the tropical forest into the subtropical forest, and these two lowest zones show little if any peculiarity in either region. The lower summits of the Western Andes and the passes over the chain lie no higher than the subtropical forest, and it is only above this level that the various portions of the cordillera are isolated. Climbing to Tatamá, there is an abrupt change from subtropical to temperate

forest. While the former possessed little that was novel, the latter yielded acquaintances new to me, in group after group. The same peculiarity and high proportion of novelty characterized the flora of the paramo. Although Cerro Tatamá has a cool zone flora, so much richer than that of Chaquiro, either upland possesses in equal sharpness of definition its own special world of life. Judging by the proportion of novelty in the groups of plants best known to the writer, most of the species existing there are yet unknown to man.

I saw on Tatamá open grassy slopes and rocky forested cliffs, while from a higher level there descended many waterfalls. Above, on the upper paramo, there must be much water,—a feature greatly in contrast with the waterless slopes of Chaquiro. My guide told of lakes and vast marshes, and of slopes covered with "fraile-jones." Evidently there remains on the true summit of Cerro Tatamá a vast world of life yet unknown, and the temptation to climb to it when so near was most severe. I left the small edge of this paramo seen by me reluctantly indeed, and with the resolve that this mountain must be visited again, in a more favorable month, and with more preparation.

Great as must be the yet undiscovered treasures of Tatamá, they can scarcely prove more interesting than those still waiting for our collecting on other isolated areas of highlands of the northern western Cordillera, or which will be found in such areas throughout the Andean mountain system. A careful comparative study of the floras of these highland areas, isolated in space and in life from one another, will help us to understand past mountain connections and to fill out our knowledge of the geologic history of the Andes. In the course of its prosecution such a study will bring to knowledge the existence of many forms of life at present unsuspected.

With the collections from Tatamá, I returned through Medellin to the coast, and sailed for the United States from Cartagena on October 3rd. Mr. Killip arrived soon after, bringing with him his plants from La Cumbré. Other specimens had been brought home by Dr. Hazen, and still others had been shipped from Cali in July. All our specimens have arrived safely, and the total collection, of over 7000 numbers or about 23000 specimens, has been already apportioned to the institutions especially concerned in the exploration.

To those who aided us in Colombia, from the government which officially gave us every courtesy, to the many individuals

who gave us everywhere a genereous welcome, our thanks are due. There is a genuine delight in working among the Colombians; in visiting such cities as Popayán; and in journeying through the Andean ranges. Needed as are now such expeditions for the scientific exploration of one of the most interesting parts of our earth, perhaps they may also serve the human goal of bringing about more personal relations between the United States and our Latin-American neighbors.

THROUGH CALIFORNIA TO THE MEXICAN BORDERLAND

By James A. G. Rehn.

In continuance of the entomological field work conducted jointly by Mr. Morgan Hebard and the Academy of Natural Sciences of Philadelphia, the purposes and incentive of which were set forth in last year's ANNUAL REPORT, Mr. Hebard and the writer, during the summer of 1922, made a reconnoissance of certain of the mountains of the Great Basin, and of parts of California and Arizona, securing about 9000 specimens of Orthoptera, and some hundreds of other insects.

After some preliminary work in Wyoming, supplementing studies of previous years, I met my associate at Ogden, Utah, on the morning of August 16, and travelled to Wells, Nevada, where we had collected in 1919, and with a delightful ranch house in Clover Valley as a base, and two horses as means of transportation, we began our examination of the Ruby Mountains. These are the highest mountains in Nevada, their extreme point being about twelve thousand feet above sea-level, their serrated crests and the slopes for a thousand or so feet down showing many areas of snow at this late date. The exceptionally severe winter of 1921–22 over all this portion of the Great Basin and northwest made a very heavy snowfall, which was still in evidence in many places. To the west of Winchell's Ranch, in Clover Valley, towered the Ruby Range; eastward stretched the vast hayfields of the valley, and beyond, purple ridge after ridge, the Pequop and Toano Ranges, with the distant summit of Pilot Peak crowning all between, and holding the

light of the setting sun long after the valley about us had turned steel-blue with the shadows of twilight.

The mountains of the Great Basin are quite different in character from those of the Rockies system, in topography and geological history, being generally tilted fault blocks with virtually no foothills, the valleys between in many sections old lake basins, arms of the great Pleistocene lakes Bonneville and Lahontan, the shrunken present-day remnants of which are Great Salt, Utah, Pyramid, Winnemucca and Malheur Lakes, Carson Sink, and a number of other spectral, yet often strikingly beautiful, desert bodies of water. The plant and animal life of the higher life zones found on these Basin ranges shows marked differences from similar zones in the Rockies and the Sierras, as for instance the complete absence of great forests of fir in the Canadian zone, a regular feature in the other regions. The desire to secure information on the Orthoptera of these higher levels was the incentive urging us to examine these elevations in the Ruby Range.

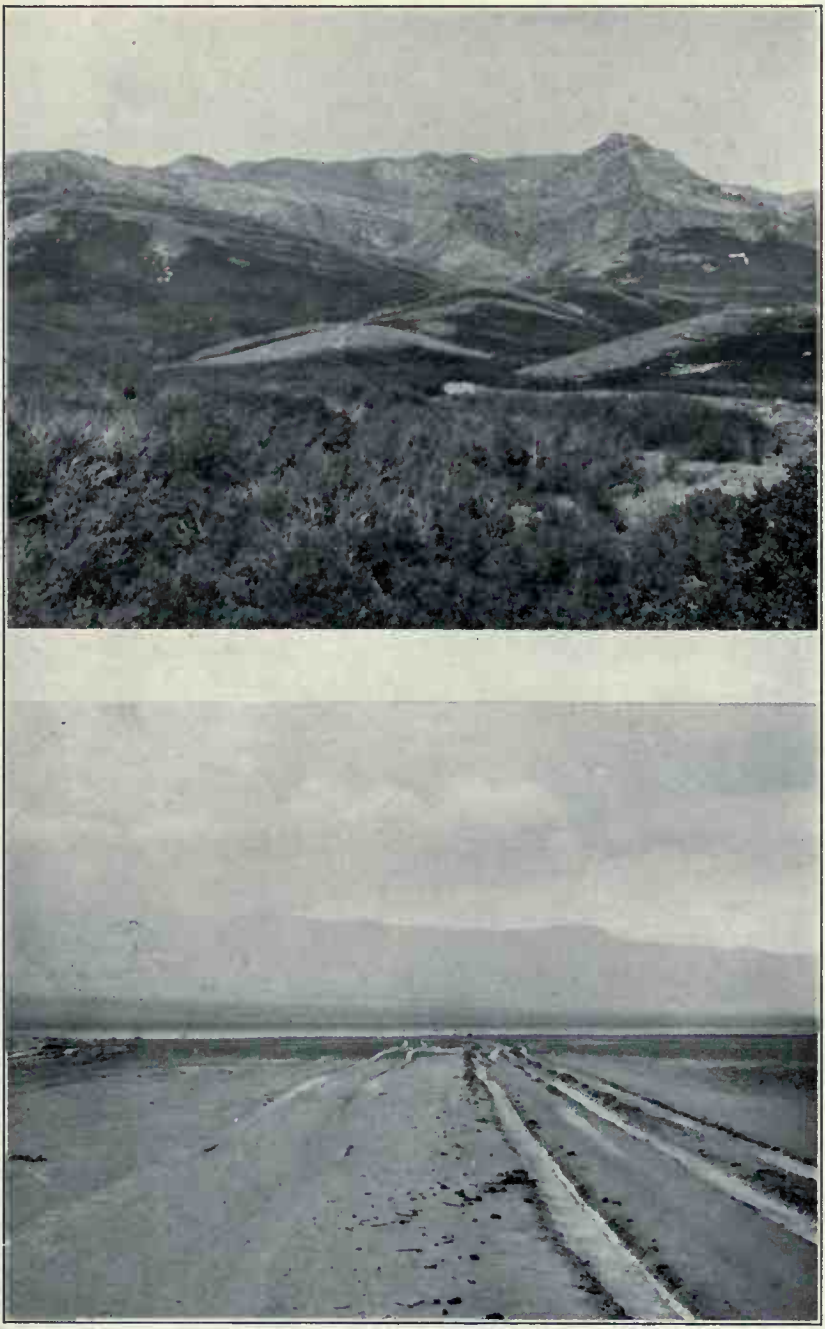
Our base in Clover Valley was at six thousand feet and we worked upward through sage, and then across broad areas of chaparral and equally bad aspen thickets. At ninety-five hundred feet, as far as horses could go, we reached snow banks,—extensive areas hundreds of feet long, filling entire small valley bottoms and sending streams of ice-cold water to the thirsty valley below. Timber extended but little above the ten thousand foot point, where many alpine flowers were in bloom, the purple lupine being everywhere. Marmots whistled all about us, the alpine chipmunks nearly twisted off their tails in gyrations born of sheer curiosity, and at ten thousand eight hundred feet, two splendid Golden Eagles were seen. Storms hung all about us, and one drenched us thoroughly before we reached Clover Valley.

From Wells we travelled by rail to Westwood, passing alongside of the intensely blue waters of Pyramid Lake, on which, like bunches of cotton, the sedate White Pelicans rode the swells, or flew close to the water in that indescribably ponderous, yet wonderfully controlled flight common to all their kind. Dusty flats stretch from Pyramid Lake to the shallow waters of Honey Lake, from which our train followed up the course of the Susan River, on the trail of the early pioneers, through historic Susanville, then up and up into the magnificent Sierran forest of yellow and sugar pine, incense cedar and firs of several species.

With Westwood, an extensive lumber town, as a base, we made a trip to the country southeast of Mount Lassen, through miles of splendid forest which has never known the axe of the lumberman, up to Juniper Lake, seventy-eight hundred feet, a Sierran gem surrounded by pointed firs, which lies at the foot of Mount Harkness. We examined Mt. Harkness from base to summit, over lava of all sizes, and glacial moraines as well, the upper slopes being above timber line and furnishing arctic alpine conditions. Some grasshoppers which we had found at similar elevations on Mt. Shasta were there to greet us, and from the summit, far off to the north, the snow mantled bulk of that splendid mountain itself overhung like a great cloud. To the west, Mt. Lassen dominated the landscape, its snow-streaked and eviscerated summit showing the effect of the recent eruption; at our feet lay the deep blue waters of Juniper Lake, while in every direction were peaks and knobs of lesser elevation, covered with heavy forest.

Leaving Westwood by automobile, we passed down the Susan Valley, past Honey Lake to the dusty saline flats at the little settlement of Amedee. The Susan Valley has great hay and alfalfa fields, the sloughs of which harbored large numbers of wild ducks. As we neared Honey Lake the ground became more and more alkaline, the dust thicker and more pungent, while the sage of the Sierran foothills gave way to the Great Basin greasewood (*Sarcobatus*). Amedee has as its sole attraction a group of hot springs, one of which is a small geyser, gushing every forty-five seconds to a height of fifteen to eighteen inches and lasting fifteen to twenty seconds. Honey Lake, which we examined at closer range next day, was inhabited by thousands of ducks, feeding in the shallows. With them were small groups of beautiful avocets, while sandpipers and kildeer ran along the shores. A ride of nine hours on a narrow-gauge railroad from Amedee, brought us to Alturas, in extreme northeastern California.

Alturas is an historic spot, as it figured prominently in the "Modoc War", and to the north and west of it stretches for many miles the great Modoc lava region. The Pitt River, a tributary of the Sacramento which works through the Sierran-Cascade axis, here meanders through a broad valley flanked by the eight hundred foot escarpment of the lava sheet. The scattered cover on the lava is made up very largely of juniper, while much of the valley



UPPER.—East Face of the Ruby Mountains, Nevada, from about 8000 feet Elevation.

LOWER.—Sink of Panamint Valley, California. Argus Range in the Distance.

bottoms is in hay fields. East of Alturas, the Warner Range extends for a number of miles in Oregon and California, a north and south Great Basin range, east of which is Surprise Valley, a Basin plain with three sink lakes. The Warner Mountains in California culminate in Warren Peak, in elevation ninety-three hundred feet, some miles southeast of Alturas, while Cedar Peak, eighty-four hundred feet, is sixteen miles to the east of that town. With our limited time we decided to study Cedar Peak, and this rugged eminence, the upper slopes of which were very steep, composed of loose decomposed rock between jutting and chimney-like pinnacles of volcanic material, furnished us with a very hard day's work, to which much heavy manzanita chaparral added its detaining hand. From the summit, to the west, Shasta, over eighty miles away, hung in the sky in a most uncanny manner, while to the east Surprise Valley yawned beneath; to the northwest beautiful Goose Lake extended away into the distance. On the summit we found the Rock Wren, while a bunch of Clark's Crows showed the distinctly boreal character of the region. Just below the summit we took one of the prizes of the trip, a wonderfully colored flightless katydid, this specimen being unique in all our collections.

From the Alturas region to the Tonopah district of Nevada is a far cry, but a desire to compare the latter region with Nevadan districts to the north, west and south, impelled us to visit it en route. The immediate Tonopah neighborhood was of considerable interest, giving us much desired information on certain species concerning which very little was known. At Millers, fourteen miles to the west, we found the more austral Nevadan element well indicated. Some of the species here taken were difficult to secure, and almost certain to escape the casual collector. One of these was a flightless, clumsy, yet most interesting katydid, and to study it, in 1919, we spent two days and two nights in locating and securing six specimens, the enabling clue being the finding of several dead specimens in one of the plants frequented by the species.

After a brief stop at Berkeley and San Francisco, we resumed work at Coalinga, California, in the southwestern section of the great interior valley, an arid region bounded on the west by the yellow hills of the Diablo Range. The open floor of the valley, with its scanty cover of yellow sun-cured grass, held some desired species, while the friendly interest of several Roadrunners assured us we were reaching more southern climes.

At Priest Valley, in the nearby mountains, we were across the divide of the range and on one of the upper tributaries of the Salinas River, which flows into Monterey Bay. The chamise or solid stand of the Chamiso bush (*Adenostoma*) was all about us on the hill slopes; we attacked it with avidity, as quite a few interesting Orthoptera are known to inhabit this shrub. Chamise beating is not pleasant work, as the dry hills and the bushes are very dusty, these having small readily detached needle-like leaves and fuzzy seed capsules. To push one's way through heavy dense chamise is as unpleasant as beating work in the same environment, but we can forgive the bush its peculiarities for the interesting and little-known Orthoptera which we have found living upon it. On the open hill slopes about Priest Valley, the tar weed was much in evidence and soon reduced our beating nets to stiff and rubbery sacks. These mountains were in the past the homeland of the California Condor, but it is now a very rare bird in these parts, as is true of most parts of the state where it formerly ranged. The bushy-tailed ground squirrels (*Ammospermophilus*) were exceedingly abundant everywhere within the hills, while the strikingly marked California Woodpecker was in evidence wherever timber was present.

From Coalinga we moved on to Bakersfield, at the southern end of the San Joaquin Valley.

Mt. Pinos, the highest peak in the southern portion of the Coast Range, or more properly, the Ventura Mountains, was visited from Bakersfield. We following the splendid highway across a portion of the San Joaquin Valley floor, then up into the mountains, winding among the wonderful oaks of Tejon Canyon to Lebec, and, leaving highways behind, due west into a region of high forested ridges and beautiful valleys. The little settlement at Downey's Ranch afforded us a base, close to Mt. Pinos, and here we did some very profitable work. The good-hearted old ranch proprietor might have stepped from one of Bret Harte's stories, representative, as he was, of the vanishing California pioneer, having had, among other things, followed Yuba Bill's profession of stage-driver, and at over seventy was still active and vigorous, just as keen a deer hunter as anyone. Northwest of the ranch lay Mt. Pinos, but a few miles away, and reaching an elevation of eight thousand eight hundred feet. An old logging road gave relatively easy access to the upper slopes, winding around the main peak itself

through forests of splendid bull pine, which reached to the summit, although the higher ravines sheltered firs, frequently of very large size. The view from Mt. Pinos was wonderful, particularly to the southeast, in which direction, although many miles away, the high peaks of the San Bernardino and San Jacinto ranges dominated the landscape.

On our return trip to Bakersfield, shortly before reaching Lebec, in a broad canyon wash, we secured series of certain of the scarcest genera of Orthoptera known from this portion of California.

Trona, on Searles Lake, was our next stop; here is the plant of the American Trona Corporation, which extracts borax, salt, potash and trona from the Searles Lake deposits. The manager of the plant was most courteous and splendid quarters were assigned to us. Here every possible arrangement seems to have been made to make life comfortable, or at least endurable, in a desert region which is exceedingly hot during much of the year. Trona was to be the base from which we hoped to reach Panamint Valley and the higher Panamint Mountains. We secured an automobile and a driver, Dickinson, who cheerfully and whole heartedly took a personal interest in our work and helped to the limit of his ability. For nearly two weeks he accompanied us in the Panamint region, and then from San Diego across to the Imperial Valley.

Panamint Valley, the great western counterpart of Death Valley, is a wonderful prospect, stretching off to the north a great distance, limited on the west by the Argus Range, dominated by Maturango Peak, on the east walled by the massive barrier of the Panamint Range, with Telescope Peak crowning all. The Panamints appear very lofty from the west, but they do not give the over-powering impression they create upon the observer on the floor of Death Valley at the foot of their eastern cliffs. This can be under-stood when it is realized that from the east they tower more than a thousand feet higher from the basal sink than they do on the west, the floor of Death Valley being so much lower.

The sink of Panamint Valley is an extensive mud saline, hardly more than a thousand feet above sea level, and the road crossing is frequently very bad. Fortunately for us we had no difficulty, although it had been very soft but a few days previous. A melancholy and unusual object was noticed here in the shape of a mired

burro, which had bogged down to its belly and perished in an upright position, the mummied corpse a grim warning of the relentless grip of the mud of a playa sink.

Huddled at the foot of the Panamint Range, just across the mud flat, and on the road which was at one time the stage road from Mojave to the now deserted mining towns of Harrisburg and Skidoo, stand the disintegrating remains of Ballarat, once a flourishing mining center and distributing point. Now its former prestige a memory, all of its permanent inhabitants gone, and but a few transient ones left, Ballarat is another of those pathetic relics of the days when gold was the great lure to the grub-stakers of thirty years ago. Like the old-time prospector Ballarat is passing, but its well of good water is a splendid asset even to-day.

North from Ballarat we travelled along the east side of Panamint Valley to the mouth of Wild Rose Canyon, which we had planned to ascend as far as we could drive our powerful machine. The mouth of Wild Rose Canyon is entered only after traversing several miles of very bad "wash," largely broken rocks, and close under-cut banks of consolidated clays and gravels a hundred feet or so high. Travelling in such places is always bad, differing only in degree, always in danger of broken springs, axles, or engine damage, on account of the roughness of the so-called road and irregularity of the strain. In addition, during the summer period of rains the bed of a wash is the natural drainage of storm water which may fall miles away, and these channels become roaring torrents almost without warning.

At three thousand six hundred feet in Wild Rose Canyon is Wild Rose Spring, a trickle of delicious water which replenished all our water cans, and for many years had served prospectors and the Skidoo stage with their necessary supply. Quite a tangle of vegetation marks the course of this little rill down the canyon, until the thirsty earth takes back its own. At five thousand feet the canyon broadened out into a bowl-like enlargement some miles across, its floor seamed with washes and low ridges, the way usually being up one of the former. The first junipers and pinyons were encountered at about six thousand feet, and then the narrowing canyon and the nearness of the main ridge ahead told us we were approaching our destination. At nearly seven thousand feet, like gigantic stone beehives, stand the old charcoal kilns, used in days

gone by for preparing fuel for smelting ore. Here we camped for several days and it proved a splendid base from which we examined the surrounding ridges and the summits of Mt. Baldy and Telescope Peak.

A relatively short climb from the kilns brought us, quite abruptly, to a low saddle in the main ridge of the Panamints, where from eighty-five hundred feet elevation we could look over the wonderful color display of Death Valley, spread out nearly nine thousand feet below. The white salines and the dunes of the burning "bottom of the bowl" were brush dabs of a titanic artist; the Amargosa Range across Death Valley showed all of its weird outline and wonderful color stripings, while far beyond, but as sharply defined as though but a dozen miles away, rose the massive bulk of the Charleston or Spring Mountain Range, about one hundred miles to the east. It was the most stupendous panorama it has been my good fortune to see, and the view from but few places in the world can equal it in sheer impressiveness and grandeur of proportions. The haze of Death Valley, that intangible veil which the furnace-like depression casts over its own impressive sterility, imparted tones of changing color to the chasm below, while the sinuous salt beds seemed now like rivers of chalky white, and again like ribbons of shining silver. Swinging the eyes from the abysmal depths to the east and looking westward, our view was almost as remarkable. Range after range—the Argus, the Coso, the Inyo—succeeded one another, their intervening valleys showing steel-blue in the light of late afternoon, while the horizon itself was formed by the snow caps of the great Sierras, with Mt. Whitney the monarch of the ridge and the highest point in the United States, clearly evident. The highest and lowest points of our land were in sight on the turn of a heel.

The ascent of Telescope Peak, eleven thousand three hundred feet in elevation, was made by Mr. Hebard and Dickinson. A few timber-line pines crept to the summit, but no distinctive arctic-alpine grasshoppers, such as occur in the Sierras, were found. This is quite in accord with our observations on other high desert ranges in California and Nevada.

The nights at our camp by the kilns in Wild Rose Canyon were cold and keeping warm was the main problem. The sky at night was generally overcast and rain was expected daily. We were fortunate, however, in this respect, but a heavy storm followed us

down the canyon, and crossed Panamint Valley after we had safely reached Ballarat on our return trip. The crusted hummocky saline mud and areas of the salt-loving plant *Salicornia* near here occupied our attention, and yielded a grasshopper which was known to frequent similar saline areas in Death Valley. As we climbed the steep grade of the pass into Searles Valley we could see the storm which had trailed us, sweeping across Panamint Valley, blowing the dust before it in a great sheet-like smoke, and throwing it far up on the eastern face of the Argus Range, while over Maturango Peak another storm raged. Trona seemed quite homelike and we spent another day in that vicinity, on the flat and in the lower canyons of the Argus Range. From Trona we went to Los Angeles, and then to San Diego to start the next section of our work.

Tia Juana, the few houses on the American side of the Mexican Boundary, was the major objective the first day of our San Diego-Imperial Valley cross-section. The famous, or perhaps better infamous, town in Mexico bears the variant name of Tijuana, but it is separated from the smaller American community by the generally dry bed of the Tia Juana River. Good-sized hills, covered with a chamise-like bush, several other shrubs and a few cacti and yucca, roll off to the eastward. The plant cover of these hills yielded one of the best finds of the summer, a katydid of which an immature specimen was in our collections, but of which the adult was previously unknown; both sexes in the adult condition were taken by us at Tia Juana. The dry wash of the Tia Juana River, the country about Chulavista and the sand dunes and salt marshes near Coronado Beach were also examined. One of the scarcest California grasshoppers was taken at Chulavista, and two most desirable species, one originally described from that locality, were taken in the Coronado environments.

Heading east from San Diego, we entered a region of good-sized hills which passed into true mountains, some very rugged and broken. We worked at Jamul and Dulzura, where, at a thousand feet above the sea, oaks began to be more in evidence. Steadily climbing over low divides, and then dropping down into other valleys, we reached the belt of chamise (*Adenostoma*) at Potrero, two thousand five hundred feet elevation. Here and at Campo, some eight miles to the east, in charming country which reminds one somewhat of eastern landscapes, profitable stops were made.

To the north of Campo a score of miles or so is Cuyamaca Peak, the highest elevation between the San Jacinto Range and the Mexican line, reaching over six thousand five hundred feet above sea level. It was one of our objectives, and from Campo we headed in that direction, through beautiful broken country with fine oaks and some pine, interspersed with meadowy areas. Guatey (pronounced "Wah-tíe") and Descanso were good collecting stations, and a summer camp near the latter place afforded excellent night accomodations. Cuyamaca Peak lay but a few miles away, and an old wood road soon placed us at the foot of the east slope of the peak. The forest cover was quite heavy,—below splendid oak, then pine with much cedar, and finally near the top some fir (*Abies*). The upper slopes were quite steep, in some places at least forty-five degree inclines. The summit bears a forest rangers' fire station, and the view from this well repays one for the climb. To the north, San Jacinto and San Gorgonio Peaks were clearly evident, and to the northwest could be seen Santiago Peak in the Santa Ana Range, although the Laguna Range to the east hid the Salton Sea and the Imperial Valley from view. The Lagunas were our next objective and we spent some hours travelling the narrow, sinuous, rocky and distinctly dangerous grade which leads into this high plateau of jumbled ridges, standing guard over the yawning desert to the east. Here a little tent camp among the whispering pines, which cover much of the Lagunas, afforded a good base.

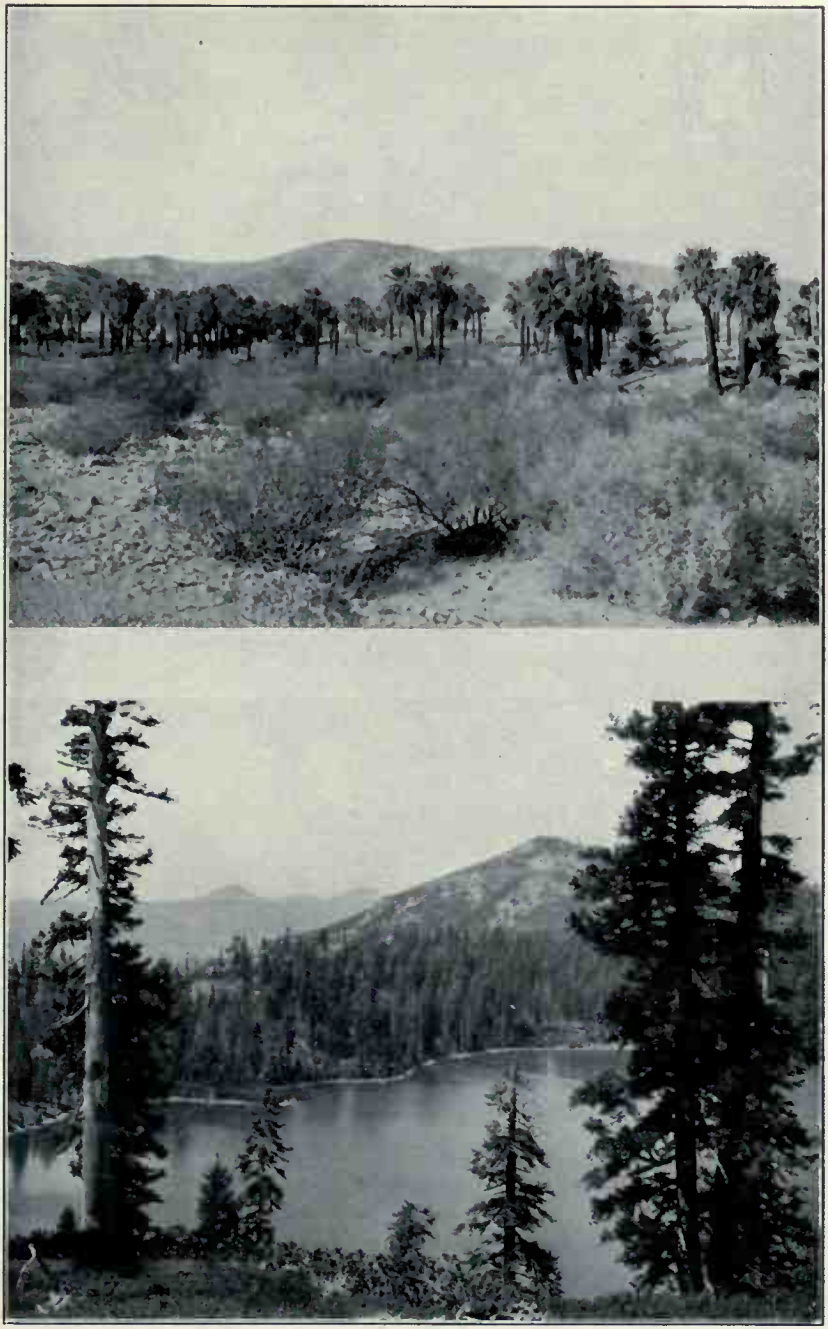
From the eastern escarpment of the Lagunas, with its cover of scrub oak, chamise and manzanita (a productive locality for us), one's view extended far to the east over the distant Salton Sea and a portion of the Imperial Valley. The slopes below the viewpoint were very abrupt, resembling in a general way, although on a smaller scale, the eastern face of the Panamint Range above Death Valley. Just a short distance below the rim of the escarpment we could see pinyon, a tree unnoticed on the coastward or San Diegan side of these mountains. Here the contact of two markedly different life areas was evident,—the San Diegan to the west and that called the Western Desert Tract to the east. The insect life, as well as the plant forms, amply support the evidence which has been secured from the vertebrates, regarding the line of contact of these two life areas in the territory from the San Jacinto Range southward.

Retracing our way to Campo, our journey was resumed parallel to and but a short distance north of the Mexican line. East of Campo the surface became more broken and rolling, with curious hills bearing erosion resistant capping stones, showing the original plateau character of the land. Jacumba Hot Springs is but a few miles west of Wagon Pass, from which the road starts the long descent to the scorching flats of the Imperial Valley. Certain of the characteristic desert plants, as creosote bush (*Covillea*), reach up tributary valleys of Carriso Creek to within less than two miles of Jacumba Hot Springs, the immediate vicinity of which is not at all like the Colorado Desert-Imperial Valley in its plant cover. About Wagon Pass numerous yuccas and cacti proclaimed the advent of more desert types. Certain grasshoppers of the Colorado Desert region, whose acquaintance we had made in past years, were in evidence at both of these localities, showing that elevation is not the essential factor controlling their distribution.

From Jacumba Hot Springs, with its cool evenings, and Wagon Pass with its elevation of three thousand seven hundred feet, our route lay steadily down hill, with a regularly mounting temperature, through the few houses at Mountain Springs, then some miles of very rugged canyon—almost a gorge in fact—past Coyote Wells, and out on the floor of the intensely hot Imperial Valley.

The Imperial Valley is but a portion of the great Colorado Desert, although the advent of irrigation, by means of canals from the Colorado River, has made possible the cultivation of a considerable portion of the lower levels of the region. Now we have thriving communities where twenty-five years ago the unredeemed desert held sway. The story of these canals, and of the destruction of their head-gates which caused the refilling of the Salton Sink, needs no retelling here. The deep gorge-like channels in the valley silt, through which the Colorado hurled its flood, are sufficiently impressive to show how the Salton came to be a "sea" again, repeating past history, as its ancient shore-lines testify.

So much of the Imperial Valley is now under cultivation that it is exceedingly difficult to find any untouched country of easy access from its bustling communities, and we soon travelled northward toward the Salton Sea and the primeval waste of the Colorado Desert. El Centro (fifty feet below sea level) and the other Imperial Valley towns were then enduring a shade temperature of 114°,



UPPER.—Fan Palms (Neowáshingtonia) of the Colorado Desert. In the Foothills of the San Bernardino Mountains, North of Indio, California.

LOWER.—Juniper Lake, Mount Lassen Section of the Sierras, California.

which was said to be quite high for September, added to which was the oppressiveness found in depressions below sea level. The summer heat has proved too great for some of the earlier settlers, and the use of Mexican and negro labor seems to be largely responsible for the agricultural success of the region.

We had one particular reason for visiting the Imperial Valley and spending more time in the Colorado Desert—to search for a very rare genus of grasshoppers previously known only from two specimens. Search in past years in the Colorado Desert, and in the Imperial Valley itself, so far had failed to reveal this remarkable insect. Kane Spring is a little desert water-hole passed after leaving the settled region, and some six miles northwest of this landmark we examined a group of absolutely bare yellow sandhills surrounded by silt and sand flats, with some areas of gravel surface covering. Here to our joy we took a most satisfactory series of the long-sought grasshopper, and were able to make most interesting and novel observations on its habits and actions.

For forty miles along the west side of the Salton Sea there is no trace of human habitations, but a splendid concrete road connects the Imperial Valley with the Los Angeles territory, and makes possible in relative comfort the study of this very desolate country. The Salton Sea stretches off to the east in the glory of its spectral blue—a desert lake which it is hard to convince oneself is not a mirage. The influence of this body of water, which has appreciably contracted in the past ten years, produces a most pleasing cool breeze, the loss of which is manifest very shortly after leaving the "Sea" behind. A short trip was made into one of the canyons of the foothills of the San Bernardino Range near Indio, where the native desert fan palm (*Neowashingtonia*) grows. This palm is the host plant of the gigantic bostrychid boring beetle *Dinapate wrighti*, to the attacks of which the splendid tree eventually succumbs, although the insect itself is very difficult to locate and secure. The original specimens of *Dinapate* are treasured possessions of the collections at the Academy, and the genus and species were first described by the late Dr. George H. Horn, long a distinguished officer and member of the institution.

Bidding California good-bye, a night train took us from Indio to Gila, Arizona. The sun came up in a pink glory, the desert mountains going from pink to purplish, then into their day colors

in that indescribable way which Arizona holds as her own. A forty-four mile railroad, which uses a motor bus on the rails for passengers, extends south from Gila (pronounced "Heé-la") to Ajo ("Ah'-ho"), a large and modern copper-mining community. The conspicuous vegetation of the country traversed is typical of southwestern Arizona, including such species as palo verde, palo fierro, cat claw, mesquite, sahuaro and cholla, excepting the first all decidedly spined or hooked and so to be respected. To the southeast Gunsight Mountain and Montezuma's Head in the Big Ajo Range came into view, while Crater Mountain was passed on the right. Far off to the west, among the multitude of other peaks and ridges, Castle Dome, about eighty miles away, was clearly evident.

The town of Ajo is in the Little Ajo Mountains, and work in these and in the grassy Ajo Valley, about six miles away, was wonderfully productive for us. The vegetation of these mountains is nearly an optimum development of the Arizona desert flora, particularly in the arborescent forms. The great pitahaya or candelabra cactus (*Cereus thurberi*) here reaches its northern limit. One of our particularly desirable finds was a fair series of both sexes of a genus and species of grasshopper known before from the United States by only a single damaged specimen.

A trip was made from Ajo to Quitobaquita, a little Papago Indian community, directly on the Mexican line and nearly forty miles south of Ajo. Our route took us through the Growler Range and down Growler Valley to the Quitobaquita Hills, the elevations all with the really fine desert vegetation seen about Ajo. Much rain had blessed this portion of Arizona, and the washes had waist-high patches of vividly green galleta grass. Quitobaquita has a good spring, several houses and a few inhabitants, and it is one of the little communities along the Rio Sonoyta, a desert river of precarious existence on the Mexican side of the line. The town has an unenviable reputation for heat, which was fully maintained the day we were there.

From Ajo we moved several hundred miles to Nogales, Arizona, about seventy miles south of Tucson. Nogales was our center for some days, and from it we examined the Pajaritos Mountains to the west, the Patagonia Mountains to the east, and some rolling country and the bottom lands of the Santa Cruz River to the north.

The Pajaritos were our most productive section in the Nogales region. They are a jumbled group of relatively high jagged peaks and pinnacles, as well as many lower ridges, largely covered with oak groves, and as a whole an extremely interesting and diversified territory to study. Our most striking results were a genus of grasshoppers previously unknown from north of central Mexico, and the previously unsecured adults of one of our rarest and most imperfectly known genera of the same family, while numerous other very desirable species were secured.

The Patagonia Mountains were not as interesting as the Pajaritos, although we examined a number of environments, extending to the highest levels. The range is by no means as broken as the Pajaritos, with more long grassy stretches on the south-facing slopes, and the oak cover more restricted to the north-facing slopes. The localities examined nearer Nogales were quite productive—grassy slopes, mesquite flats and groves of huge cottonwoods along the river bottom.

From Nogales we moved eastward, following the boundary line quite closely, working at Fairbanks, Naco, Osborn, Douglas and San Bernardino Ranch, all in Arizona. From Naco we made a side trip to Don Luis, at the foot of the Mule Mountains, then through the copper town of Bisbee to Mule Pass in the same mountains. From Mule Pass we climbed to two nearby summits, reaching about seven thousand two hundred feet elevation. At Don Luis we found a foot hill element in the Orthoptera which was absent from the flat at Naco, although weakly indicated in the limestone hills at Osborn about six miles away. The higher Mule Mountains were not markedly productive or interesting to us, probably because the range is not high enough to carry boreal conditions, yet the upper slopes are too cold for more typically south Arizonan types.

The name of San Bernardino Ranch is a familiar one in distributional entomology, as Prof. Snow of the University of Kansas spent most of a summer there some fifteen years ago, and his collections made at that locality have been studied by many students. Our visit was made to secure additional information and material, and we were very successful. San Bernardino Ranch lies over twenty miles east of Douglas, across the low Perilla Mountains, and at the lowest level, in the United States, of the San

Bernardino Valley, which drains southward into the basin of the Rio Yaqui of Mexico and is separated from the San Simon Valley to the north by low hills. A portion of the ranch property is in Mexico, and its extensive areas of sacaton grass were very profitable collecting grounds. The rough surface of the nearby "bench," with a covering of lava fragments, was of equal interest to us.

From Douglas we moved eastward to our last collecting district at Hachita, New Mexico. From Hachita we made a short trip to the Hachita Grande Mountains, about thirty miles by the route followed. In Playas Valley at the west foot of the range, we found an area of black brush (*Flourensia cernua*), which yielded important material, while a pull from this point of a thousand feet higher, to five thousand five hundred feet elevation, placed us in a broad canyon relatively close to the towering Hachita Peak itself. Mr. Hebard worked through the juniper and pinyon belt to a point above which sheer cliffs made the main peak inaccessible from the west side. The canyon floor and the nearby juniper and pinyon-clad slopes yielded many forms of interest. This same range had been examined a number of years ago by Dr. Pilsbry of the Academy, who, in his search for land mollusks, ascended the peak from the east.

Leaving Hachita the evening of September 27, a brief stop to repack material was made at El Paso, and on the morning of October 1st, we reached Philadelphia, after a most profitable and interesting, as well as enjoyable, trip.

THE ACADEMY'S DEPARTMENT OF BIRDS

By Witmer Stone.

The visitor to a large museum such as that of the Academy sees only the specimens which are displayed in the exhibition halls. Formerly all specimens were so displayed and persons unfamiliar with modern museum methods still have the idea that these exhibits include all of the museum's collections. This, however, is by no means the case and the specimens on exhibition often constitute a comparatively insignificant portion of the museum's resources.

A Series of Moth-proof Metal Bird Cases in the Ornithological Study Room.

A Case opened to Show Arrangement of Skins in Drawers

It seems desirable to make this fact clear both to our members and visitors and to explain the extent, relationship and objects of the several collections in each department, so that a clearer conception of our needs and resources may be obtained, and in this year's report we propose to consider the department of birds, as being perhaps best calculated to illustrate the subject.

When a corps of specialists in the various branches of natural history took the place of the single museum curator of old, their duties were not only the supervision of the exhibits in their respective departments, but also the prosecution of original research. This necessitated the acquisition of many more specimens than the two or three of each kind which formed the mounted collection in the exhibition hall. There must be specimens showing variation due to sex, age, season and environment. Furthermore, the specimens must be of a character suitable for easy handling, and comparison. Thus was developed the skin collection, a bird "skin" being a stuffed specimen, resembling a dead bird lying on its back with its wings close to the body, but without the glass eyes, wires, etc., characteristic of the mounted specimen. The wings, feet, bill and feathers of such a specimen may be examined with ease which is not possible with a mounted bird, and if the need arises a skin may be relaxed by steaming and can be mounted if desired.

The museum's "study collection" of skins is very much larger than the exhibition collection of mounted birds, for several reasons. As already stated a series of specimens is required for the research work being carried on in the department, far larger than the number needed for exhibition; then again many closely allied forms which would not be distinguished by the average visitor are preserved only in the study collection and so also with most of the very rare or historic specimens. The reason for this is a very important one, namely that the colors of bird plumage are seriously affected by light, and a mounted specimen even though not exposed to direct sunlight will inevitably fade and is soon useless for scientific study. The extend of fading varies in different species, and many specimens that have become useless for technical research, retain their colors sufficiently well to serve as exhibits for many years.

It should be clear to anyone, however, that the only reliable, permanent collection of birds is the study collection of skins. It can be constantly added to and brought nearer and nearer to com-

pletion, while the exhibition collection is ever deteriorating and has to be replenished, much as a collection of live birds in a zoological garden, or an aviary, which suffer the loss of specimens by death almost as fast as they receive new accessions.

The study collection should be regarded in the same light as a scientific reference library, where rare old volumes are preserved for centuries and carefully guarded against deterioration. And how are our study collections of bird skins preserved? In metal cases fitted with clamped doors, which render them dustproof, lightproof, and mothproof, the specimens being arranged in shallow drawers, and labelled with tags bearing information relative to the date and place of capture, sex, age, etc.

The chief aim of the Academy's ornithological department today is to secure for the study collection specimens of such birds as are not now represented, so that they may be preserved for examination and study by future ornithologists when, and at no distant time, many of them will be unobtainable. This need is urgent and immediate and we should be enabled to secure important disiderata by purchase whenever opportunity offers.

Up to 1888, the Academy's collection of birds was almost entirely mounted, some 25,000 specimens mounted on T-perches being displayed on shelves where they stood, rank upon rank, so crowded that only a few were visible. Since then about three-quarters of these specimens, including the historic types of early authors and large numbers of duplicates have been reduced to skins, while some 40,000 modern "skins" have been secured by expeditions, purchase, and gift.

The old collection was largely the private collection of Dr. Thomas B. Wilson which included the Rivoli (Massena) Collection, the Gould Collection of Australian birds, and many smaller collections purchased in London and Paris from 1845 to 1855. There were also many specimens obtained on the early government expeditions received in exchange with the National Museum; specimens obtained in the west by Townsend, Gambel, Heerman and Woodhouse. This collection was largely assembled during the period of John Cassin's activity, and its value was vastly enhanced by the years of study that he spent upon it. From the time of his death in 1869 until 1888, when the writer assumed charge of the collections, practically no accessions were made, but from that time they have been many.

Explorations have been carried on, wholly or in part ornithological, from which the collections have come to the Academy, as follows:

1890. Yucatan and Southern Mexico (W. Stone and F. C. Baker).
1890–91. Bahamas and Jamaica (J. P. Moore).
1891. Florida, Texas, and Arizona (S. N. Rhoads).
1891–2. Greenland (W. E. Hughes and Langdon Gibson).
1892. British Columbia and Washington (S. N. Rhoads).
1894–95. Somaliland (A. Donaldson Smith).
1895. Aleutian Islands (Benjamin Sharp).
1897. Borneo (A. C. Harrison, Jr., W. H. Furness).
1897. Sumatra and outlying Islands (Van der Pol Colln).
1897. Manchuria (A. D. Smith, Geo. L. Farnum).
1897. California (A. S. Bunnell).
1897–98. Alaska (E. A. McIlhenny).
1901. Chihuahua, Mex. (W. E. Hughes).
1902. New Mexico (H. L. Viereck and J. A. G. Rehn).
1904. British East Africa (Geo. L. Harrison, Jr.).
1905. Lower California (S. N. Rhoads).
1907. Philippines (E. H. Porter).
1910–16. Colombia (M. A. Carriker, Jr.).
1910–13. Panama (L. L. Jewell).
1911. Venezuela (F. E. Bond, T. S. Gillen and S. Brown).
1911. Ecuador (S. N. Rhoads).
1911. Philippines (Jos. Clemens).
1911–12. Cameroon (G. L. Bates).
1915. Guatemala (S. N. Rhoads, E. L. Poole).
1919. Chiricahua Mts., Arizona (W. Stone).
1922. Nicaragua (Wharton Huber and J. Fletcher Street).

Several large collections covering many countries have also been received:

W. L. Abbott (by gift) a collection covering, Cuba, San Domingo, N. Dakota, Iowa, Pennsylvania, and New Jersey.

Canon Tristram (by purchase), a collection covering the world. especially rich in island forms.

Josiah Hoopes (by gift and purchase), a very complete North American collection.

And many smaller North American and foreign collections.

With the development of the research collection it must not be thought that the exhibition collections are neglected. Many freshly-mounted specimens have been presented and others prepared in our taxidermical shop to replenish the exhibits.

A nearly complete local collection is now displayed, mainly through the coöperation of the Delaware Valley Ornithological Club; and a seasonal exhibit is arranged to show the sequence of arrival of migrants in Spring, both of which are constantly consulted by local bird students. As an adjunct to these a local collection of skins of Pennsylvania and New Jersey birds is kept separate from the main series for the use of more advanced local students.

Future aims are to arrange the exhibits into faunal and systematic series, and to add groups illustrating life histories, and special phases of bird life, as fast as means are available.

It should thus be clear that two lines of activity are being constantly maintained. (1) The preservation of our historic, scientific, research collection, with the idea of making it as nearly complete as possible and to further technical ornithological study. (2) The maintenance of exhibition collections which shall be as instructive as possible, and yet not involve the deterioration of specimens whose scientific value demands their most careful preservation.

Report on the Museum

ADMINISTRATION OF THE MUSEUM

BOARD OF CURATORS.

WITMER STONE, *Executive Curator.* HENRY A. PILSBRY, *Secretary.*
T. CHALKLEY PALMER, GEORGE L. HARRISON, JR.

SCIENTIFIC STAFF.

Vertebrate Zoology.

WITMER STONE, *Special Curator.*
WHARTON HUBER, *Assistant Curator, Birds and Mammals.*
HENRY W. FOWLER, *Assistant Curator, Fishes and Reptiles.*

Mollusca and other Marine Invertebrates.

HENRY A. PILSBRY, *Special Curator.*
EDWARD G. VANATTA, *Assistant Curator.*

Insects.

HENRY SKINNER, *Special Curator.*
JAMES A. G. REHN, *Assistant Curator.*
E. T. CRESSON, JR., *Assistant Curator.*
MORGAN HEBARD, *Research Associate.*
ROSWELL C. WILLIAMS, JR., *Research Associate.*

Plants.

FRANCIS W. PENNELL, *Special Curator.*
BAYARD LONG, *Research Associate.*

Minerals and Rocks.

FRANK J. KEELEY, *Curator of the William S. Vaux Collections.*
SAMUEL G. GORDON, *Assistant Curator, in charge of the General Collection.*

Archeology.

MISS H. NEWELL WARDLE, *Assistant Curator, in charge.*

Ludwick Department of Public Instruction.

HAROLD T. GREEN, *in charge.*

Taxidermist.

DAVID MCCADDEN.

The Museum halls have been open as usual to the public during the year and have been visited by large numbers of persons, especially classes of school children from the city and nearby suburbs.

Through the coöperation of the Ludwick Institute, the services of Mr. Harold T. Green have been available throughout the past year, and besides managing the Ludwick lecture courses, he has accomplished much in increasing the educational value of the museum exhibits and in general publicity work, thereby making known the activities of the Academy both in the field and in the museum.

Several important exhibits have been prepared during the year, notably a series of casts of the reptiles and batrachians of Pennsylvania and New Jersey, which will soon be placed in special cases with descriptive labels to supplement the collections of local birds and crustaceans already on exhibit, the intention being to eventually provide as complete a series as possible illustrative of the zoology of the vicinity of Philadelphia.

A special exhibit which has been in preparation and will be displayed in the near future, is a group of Bald Eagles, the nest, with the tree top in which it was located, having been secured for the Academy by Mr. Arthur H. Fisher, from the shores of Chesapeake Bay.

Entomological exhibits illustrating the life-history of the destructive Japanese Beetle and the harmless Chinese Mantis, both recently introduced into this vicinity and at present attracting much popular interest, have been prepared by Mr. Green.

The seasonal collection of mounted birds was again displayed during the Spring months to show just what species may be looked for every week in the neighborhood of Philadelphia as the migration advances, and attracted much interest, as did the similar exhibit of pressed wild flowers.

The scientific staff has been fully occupied with the care and study of the research collections, and much important progress has been made, details of which are given in the reports of the several departments.

The Academy has been particularly fortunate in the amount of field-work which it has been able to carry on during the year.

Messrs. Wharton Huber and J. Fletcher Street visited Nicaragua in the interests of the institution, and secured valuable collections especially of birds, mammals and insects. The travelling expenses of this expedition to Bluefields and back were generously subscribed by members of the Academy; and during their stay in the country the members were the guests of Dr. Theodore E. Bouchell and the officers of the Tonopah Mining Company, who did everything in their power to aid them in carrying on their work. Mr. J. A. G. Rehn was enabled to join Mr. Morgan Hebard in another reconnaisance of parts of California and Arizona for the collecting of Orthoptera, the Academy sharing with Mr. Hebard in the material obtained. Dr. H. A. Pilsbry spent three months (September to November) in the eastern ranges of New Mexico and the Big Bend region of Texas, collecting mollusca in the San Andraes, Organ, Sierra Blanca, New Mexico, and the Guadalupe and Chisos ranges of Texas. The object of this trip was to map the eastern limits of the characteristic desert groups. Mr. Rehn's and Dr. Pilsbry's expenses were provided for by members of the Academy.

Dr. Francis W. Pennell, coöperating with the N. Y. Botanical Garden, the Gray Herbarium, and the U. S. National Museum, headed an expedition to the Colombian Andes for the purpose of continuing his botanical researches in the region, and secured some 23000 specimens, which the Academy shares equally with the other institutions, in return for Dr. Pennell's services. He had as his field associates Mr. E. P. Killip, of Washington and Dr. T. L. Hazen, of Columbia University.

Mr. Henry W. Fowler, in the same way, is securing for the Museum a very valuable series of Pacific fishes in return for determining the collections in the Bishop Museum in Honolulu, his expenses being covered by the award of a Yale University Pacific scholarship. He left on August 1, and will return in April of next year, spending some time in collecting desirable material on the coast of California.

Realizing the imperative need for additional cases for housing the study collections in various departments, and funds to carry on several of the expeditions just described, the Curators were authorized by the Council to endeavor to raise funds for the purpose, and thanks to the generosity of our members, a sum of over $5000

was subscribed, with which cases for insects, plants and birds, were procured, sufficient to care for the accessions of recent years, and two exhibition cases for the Archeological Department.

Details of the work in the several departments follow.

MAMMALS

Many interesting specimens were received from the Zoological Society of Philadelphia, including a Snow Leopard, which has been mounted and placed in the exhibition series.

A collection of 60 Nicaraguan mammals was obtained by the Academy expedition, among which is a series of Mantled Howler Monkeys,—males, females and young. Many skeletons have been prepared for the study collection, and a large number of skulls, cleaned.

Specimens have been loaned during the year to the U. S. Biological Survey and H. E. Anthony.

BIRDS

The absence of Mr. Huber in the field, and illness of Dr. Stone, seriously interfered with extended work on the research collections, but accessions have been cared for, and many of the cases have been more fully labelled to facilitate consultation of specimens. Mr. Huber, since his return, has been engaged upon the identification of the Nicaraguan collection which numbers 625 specimens including many species not hitherto represented in the Academy's series.

Other notable accessions during the year have been a selection of the most interesting specimens from the collection of the late George Spencer Morris, comprising local material and a series of skins from Puget Sound; the entire collection of skins of Dr. William E. Hughes, comprising many formerly in the collection of John Krider, as well as recent series from Maine, the New Jersey coast, etc.

Material has been loaned during the year to Dr. F. M. Chapman, W. E. Clyde Todd, James P. Chapin, and others.

REPTILES AND BATRACHIANS

Many specimens have been obtained by the staff and correspondents from which casts of 36 local species have been prepared by Mr.

McCadden, the taxidermist, and Mr. Green of the Ludwick Department of Public Instruction, and it is hoped to complete this exhibit next year.

Mr. Fowler, before leaving for Honolulu, cared for all accessions received up to that time, including many obtained by the Nicaragua expedition.

A specimen was loaned to Mr. E. R. Dunn.

FISHES

Mr. H. W. Fowler reports that the examination of the study collection was completed before he left for Honolulu, and the jars replenished with alcohol, wherever necessary.

All of the specimens from Oceania were studied and determined in connection with this proposed work at the Bishop Museum; and reports prepared on collections sent from the American Museum of Natural History; Messrs. Marley and Robinson, Natal, South Africa; and James Hornell, Esq., of the Madras Fisheries Department, India, from all of which the Academy received duplicates.

Three papers were prepared for publication by the Academy: On Freshwater Fishes from the Southern Alleghanies; On Fishes received from Madeira, Madagascar, Syria, and Australia; Fishes from Nicaragua.

INSECTS

Dr. Skinner, Special Curator of Insects, reports that upwards of 9000 specimens have been added to the collections during the year, not including several thousand obtained by the Academy-Nicaraguan expedition. Miss Caroline H. Lane, whose services were secured at the beginning of the year, has been engaged in mounting the accumulation of unstudied material, and has made much progress, while many of the specimens have been named and incorporated in the collections.

The valuable collection of Odonata made by Dr. P. P. Calvert, probably the finest in America, has been presented to the Academy, bringing our representation of dragon-flies, etc., into the very first rank.

Dr. Skinner and Mr. R. C. Williams, Jr., have paid especial attention to the Lepidoptera and have published a paper on the male genitalia of the larger Hesperidae of North America.

The collection of Diptera is steadily growing and has been under the care of Mr. E. T. Cresson, Jr. More than 275 specimens have been received from various sources, including 115 specimens of 60 species, mostly from South America and East Indies, containing many paratypes. The family Borboridae has been studied by an authority and contains over 525 specimens and 75 species, of which many are to be described as new. A large collection of the family Micropezidae, mostly from South America and the East Indies, has been studied by Mr. Cresson, among which many new species were found and will shortly be described. The material retained will increase the Academy's collection in this family about 75 per cent. Much time has been given to the material sent in for determination, which, in most cases, has been added to the collection. The Diptera collected by the Academy expeditions are being studied and reports on these are in preparation. Mr. Cresson has also labeled and numbered the Bassett types of the hymenopterous family Cynipidae. Of the 125 species described by Mr. Bassett, the collection contains all but two. The following papers have been prepared by Mr. Cresson in the course of his studies of the collection and published, or are in press: Studies in American Ephydridae; Descriptions of New Genera and Species of Ephydridae; and, The Bassett Types of Cynipidae.

In the Orthoptera, Messrs, Rehn and Hebard have continued the rearrangement of the exotic series, almost the entire series of Tettigoniidae having been handled and large series of recently determined material interpolated. Similar work has been accomplished upon a large part of the exotic Acrididae.

Mr. Rehn has made an extensive study of the Blattidae of the West Indies, and upon certain genera of North American Acrididae. Progress has been made upon several papers on African Orthoptera, which have been under way for some years. An important collection, made in the Amazonian region of Brazil and Peru, has been received for study from the Royal Swedish Natural History Museum, a representation of the material to remain at the Academy in return for its study.

Mr. Hebaid has completed studies of three genera of North American Acrididae, and has continued his studies of Panamian and Colombian Orthoptera into the families Mantidae, Phasmidae and Acrididae. A second most important collection of Guianan Blat-

tidae has been partially studied by him, and very satisfactory arrangements made with the Paris Museum for the retention of a large part of the series. Very important exchanges with the British Museum of Natural History have been negotiated by him, which added numerous genera to our collections. He has secured by purchase, and otherwise, important collections of Orthoptera from Peru, Venezuela, Bolivia, Katanga in the Belgian Congo, British India, Philippines and China.

Papers published during the year by Mr. Rehn are: Descriptions of New and Critical Notes upon Previously known Forms of North American Oedipodinae. Paper II. (In: Trans. A. E. S., 27 pp. 2pls.) Studies in Costa Rican Dermaptera and Orthoptera. Paper I. (In: Trans. A. E. S., 12 pp. 1 pl.) Contributions to our Knowledge of the Dermaptera and Orthoptera of the Transvaal and Natal. Part I. Dermaptera and Blattidae. (In: Annals of the Transvaal Museum. 99 pp. 4 pls.)

By Morgan Hebard: Mexican Records of Blattidae. (In: Trans. A. E. S., 22 pp. 1 pl.) South American Blattidae from the Muséum National d'Histoire Naturelle, Paris, France. (In: Proc. Acad. Nat. Sci. Phila., 112 pp. 7 pls.) The Janeirensis Group of the Genus Euborellia, etc. (In: Trans. A. E. S., 6 pp. 2 pls.) The Dermaptera and Orthoptera of Hawaii. (In: Occas. Papers Bernice Pauahi Bishop Mus., 72 pp. 2 pls.) New Genera and Species of Melanopli found within the United States and Canada. Part IV. (In: Trans. A. E. S., 28 pp. 2 pls.) Notes on a Few Interesting Blattidae from Guatemala, with the Description of a New Species. (In: Trans. A. E. S., 4 pp.) North American Acrididae. Papers I, II. (In: Trans. A. E. S., 20 pp. 1 pl.)

Many entomologists have consulted the collections during the year, and much assistance has been given local students and school children in the identification of specimens.

Specimens were loaned to B. Uvarov, and Morgan Hebard.

PLANTS

During the early part of the year there was prepared a complete inventory of the collections of the Academy on hand and as yet unmounted. For the general herbarium over thirty collections from various sources have been mounted during the year, representing a total of over 6000 specimens. We have vast collections

not yet in the herbarium; and the mounting of the rich herbaria of Mr. C. W. Short, one of the chief private American herbaria of the past century; of Prof. T. C. Porter, for many years the most prominent student of Pennsylvania plants; and of several others, is much to be desired.

The housing of the Herbarium in metal dust-proof and insect-proof cases has just been completed. The mounted collection is now, excepting a portion of the local herbarium, safely cared for.

The rearranging of the general herbarium for the purpose of facilitating rapid geographical reference has enlisted a number of volunteer assistants, especially Dr. Henry Leffman, and Miss Alice O. Albertson, to whom our thanks are due.

During the college year of 1921–22, we were fortunate in having the assistance of Mr. John M. Fogg, Jr., a student of the University of Pennsylvania, who rendered invaluable assistance and took general care of the department during Dr. Pennell's absence in South America.

Research study in the herbarium has been much aided by the addition to our equipment of a modern binocular microscope, but owing to absence on field-work, Dr. Pennell has accomplished little new study during the year. The study of the Scrophulariaceae of the central Rocky Mountain States has been nearly completed; and notes prepared dealing with the species of this family in the Santa Catalina Islands, California, and of the genus *Pentstemon* in Indiana. A paper on the Scrophulariaceae of the west Gulf States has been published in the PROCEEDINGS of the Academy.

From April 25 until October 18, Dr. Pennell was engaged in botanical collecting and exploration in the northern Andes of Colombia, as already explained; and besides the work of collecting, special field work was done in the study of the Andean Scrophulariaceae, and in the distribution of the plant life of the high cordilleras.

The local herbarium continues under the efficient care of Mr. Bayard Long. Work has progressed in the geographical sorting of the specimens, and the collection is second to none in its preservation and arrangement. New metal cases, have permitted a much needed expansion. Since February, Mr. George W. Bassett has been employed in mounting specimens. This enables us to add Mr. Long's very extensive personal collections, which consist of valuable and unusually beautiful specimens.

Specimens were loaned to C. A. Weatherly, K. K. McKenzie, H. St. John, and E. B. Payson.

MOLLUSKS

Accessions were received from 73 persons and institutions.

In the *Manual of Conchology* the account of Orculinae, a subfamily of Pupillidae, has been prepared and partly published.

In collaboration with Mr. Ferriss, the Special Curator has prepared a paper dealing with the distribution and anatomy of land-shells of central Arizona.

Mr. Vanatta has been chiefly employed in identifying specimens for correspondents, in preparing new material, and in working over and selecting specimens from several general collections received.

About 888 specimens have been loaned for study to twelve investigators in other institutions.

MINERALS

Mr. Samuel G. Gordon has continued in charge of the collection in this department. During the past year his time was largely spent in crystallographic investigation of minerals secured on the Vaux–Academy Andean Expedition of 1921, and at Franklin, N. J.

Mr. Gordon spent part of the summer of 1922, visiting the feldspar, mica and corundum mines of southwestern North Carolina; and shorter trips were made during the fall to Franklin, N. J., and Branchville, and Middletown, in Connecticut.

The most notable accession of the year was the collection of the late William H. Shaw, presented by his son, Charles K. Shaw. The collection is particularly rich in fine amethysts, garnets, beryls and felspars from Delaware County, although it is by no means limited to local minerals.

Other accessions are noted in the report of the Curator of the William S. Vaux Collections.

ARCHEOLOGY

The Department of Archeology has continued under the care of Miss H. Newell Wardle.

During the year 1922, donations amounting to 567 specimens were received, exclusive of Mr. Clarence B. Moore's addition to his collections. Some of the objects received are extremely rare.

Changes have been made in the arrangement of the department, to create an Egyptian section, which, besides being of never-failing interest to the public, gives promise of growth in the near future. The African and West Indian exhibits have also been rearranged; and a special display of Malaysian objects are shown in the case for temporary exhibits.

Mr. John L. Baer, of the U. S. National Museum, made a study of the Academy's series of "banner stones," in connection with a forth-coming monograph.

No papers were published during the year, but study was continued upon the stone ceremonials of the eastern United States, which will be published as soon as the illustrations are completed.

At the request of the Camden County Historical Society, Miss Wardle classified and arranged the archeological collection of that institution.

REPORT OF THE CURATOR OF THE WILLIAM S. VAUX COLLECTIONS.

During the past year, 47 specimens were purchased in addition to series of minerals from Franklin, N. J., and Langban, Sweden.

Noteworthy among these are lead and inesite crystals from Langban, Sweden; strengite, Pleystein, Bavaria; dipotase, Otavi, Africa; and tephroite crystals, Franklin, N. J.

Among species new to the collection, the Vaux-Academy 1921 Andean Expedition yielded the following,—vauxite, paravauxite, keeleyite, daubresite, sphaerite and rhomboclasite, of which the first three are new species, described during the year by Mr. Samuel G. Gordon.

Other minerals not hitherto represented in the collection, include ferrierite, presented by Dr. W. F. Ferrier; haidingerite, invoite, hulsite and orientite, obtained by exchange; and the following, which were purchased: miersite, xanthoxenite, otavite, thortveitite, phosphosiderite, barthite, phosphoferrite, phosphophyllite, ectripite, kezekite, catoptrite, dixenite, curite and kasolite.

The excellent condition of the collection continues to be due principally to the assiduous efforts of Mr. Gordon.

Respectfully submitted

F. J. KEELEY,

Curator, William S. Vaux Collections.

ADDITIONS TO THE MUSEUM

1922

MAMMALS

ACADEMY NICARAGUAN EXPEDITION. 60 specimens of mammals.

T. W. ANTHONY. Porpoise skull, Barnegat, N. J.

SAMUEL G. GORDON. Cat skin, Bolivia.

H. P. JAMES. 2 Squirrel skins, Nicaragua.

DR. W. W. KEEN. Several small mammals mounted.

JAMES S. MCKENZIE. Skin and skull of Opossum and Otter, Nicaragua.

HOWARD A. PERKINS. Mounted Moose head. (*Alces americanus*), Ontario, Can.

PHILADELPHIA ZOOLOGICAL SOCIETY. Skin and skull of Porcupine; Wombat (*Phascolomys ursinus*); Snow Leopard (*Felis uncia.*); Manatee skeleton, Florida.

BIRDS

DR. WM. L. ABBOTT. Jacana skins (*Jacana violacea*), San Domingo.

ACADEMY EXPEDITION TO NICARAGUA. Collection of 625 bird skins.

MRS. JOHN A. BROWN. Thirteen mounted Birds.

PURCHASED. Collection of bird skins, Bolivia.

MRS. I. S. FISHBLATT. Two Old Squaw Ducks (*Harelda hyemalis*), Atlantic City, N. J.

RICHARD B. FREEMAN. Collection of bird eggs.

MRS. E. T. GILL. Little Auk (*Alle alle*), Beach Haven, N. J.

DR. WILLIAM E. HUGHES. Collection of bird skins, Pennsylvania, New Jersey and Maine.

MRS. WALTER JACKSON FREEMAN. Collection of bird eggs.

F. GUY MEYERS. Two Red Shoulder Hawks (*Buteo lineatus*); Four Red-tailed Hawks (*Buteo borealis*), Llanerch, Pa.

GEORGE SPENCER MORRIS EST. Collection of bird skins, Pennsylvania, New Jersey and Washington.

DAVID MCCADDEN. Barn Owl (*Tyto pratincola*), Pennsylvania.

T. STORDY. Young Night Hawk (*Chordeiles virginianus*), Philadelphia.

DR. T. SEYDEL VACA. Three Parrots (*Amazona albifrons, Aratinga canicularis, Brotogerys jugularis*), Nicaragua.

AMPHIBIANS AND REPTILES

ACADEMY EXPEDITION TO NICARAGUA. Two jars of Reptiles.

WILLIAM J. FOX. Mud Turtle (*Kinosternon pennsylvanicum*), Bowers, Delaware.

DAVID MCCADDEN. Garter Snake (*Thamnophis sirtalis*), Pennsylvania; Two Tree Toads (*Hyla versicolor*), Pennsylvania.

JAMES A. G. REHN. Horned Toad (*Phrynosoma regale*), Arizona.

JAMES L. SHOCH. Wood Turtle (*Clemmys insculpta*); Box Turtle (*Didicla carolina*); Muhlenberg's Turtle, (*Clemmys muhlenbergii*); Black Snake (*Bascanion constrictor*), Quakertown, Pa.

J. B. TOWNSEND, JR. Rattlesnake (*Crotalus horridus*), Pennsylvania.

GUSTAV WEBER. One Red-bellied Snake (*Storeria occipito-maculata*), New Jersey.

R. W. WEHRLE. Queen Water Snake (*Regina leberis*), Pennsylvania; Sticky Salamander (*Plethodon glutinosus*); Ring-necked Snake (*Diadophis punctatus*); House Snake (*Lampropeltis doliatus clericus*); Grass Snake (*Liopeltis vernalis*); Box Turtle (*Didicla carolina*); two Snapping Turtles (*Chelydra serpentina*); one jar Salamanders; two Purple Salamanders (*Gyrinophilus porphyriticus*); one Pilot Black Snake (*Elaphe obsoletus*).

CHESTER WERNER. Red-bellied Turtle (*Pseudemys rubiventris*), New Jersey

FISHES

ACADEMY EXPEDITION TO NICARAGUA. Two jars of Fishes.

AMERICAN MUSEUM OF NATURAL HISTORY. Sixty-seven fresh-water fish, E. Mongolia, China. (Duplicate set, collected by Third Asiatic Expedition.)

HENRY W. FOWLER. Five jars fresh-water fish, Virginia.

JAMES HORNELL. Gobioid fish, Madras, India.

M. B. HUSTON. Gar pike *Lepisosteus tropicus*, Nicaragua.

DR. ADOLFO CESAR DE NORONHA. Collection of fishes, thirty-three species, Maderia Islands.

PEDRO SERIE (Purchased). Collection of fishes, Argentina.

WISTAR INSTITUTE OF ANATOMY. Two collections of fishes, British North Borneo.

INSECTS

DR. W. L. ABBOTT. Four insects, San Domingo.

ACADEMY EXPEDITION TO NICARAGUA. Collection of several thousand insects.

R. R. ALLEN. Four insects, Maine.

M. BEZZI. Fifteen Diptera, Africa and South America.

F. E. BLAISDELL. One hundred and eighty-two Coleoptera, California.

DR. THEODORE BOUCHELLE. Fifteen Orthoptera, Nicaragua; one hundred and fifty Insects, Nicaragua.

E. P. BUCKELL. Seven hundred and twenty-five Orthoptera, British Columbia, Canada.

DR. PHILIP P. CALVERT. Eight Odonata, United States; twenty-six insects, Central America and United States.

D. M. CASTLE. Seven Hymenoptera, Hawaiian Islands.

A. N. CAUDELL. One Zoraptera, Hawaii.

B. P. CLARKE. *Ornithoptera urvilliana*, Soloman Islands.

T. D. A. COCKERELL. Twenty-one Insects.

K. R. COOLIDGE. Sixty Lepidoptera, California.

W. J. COXEY. Two *Chelepterix collesi*, Australia. *Attacus dohertyi*, Tenimber Islands.

WM. T. DAVIS. *Tibicen robinsoni*, Virginia.

C. W. DRAKE. Twenty-five Hemiptera, United States.

H. C. FALL. Sixty-two *Gyrinus*, United States.

T. H. FRISON. Ten Hymenoptera, United States.

HEBARD-ACADEMY EXPEDITION OF 1922. Collection of 4500 Orthoptera, Western United States.

M. HEBARD. Two hundred and seventy-six Lepidoptera, Western United States; three Moths, Wyoming; forty-four Coleoptera, India.

DR. WM. E. HUGHES. Two hundred and ten insects, Fiji and Samoa.

F. M. JONES. Collection of insects, Mississippi, Florida, Arizona.

PHILIP LAURENT. Five moths, Florida; eleven Diptera, Florida.

R. A. LEUSSLER. Twenty-five Hesperidae, Nebraska.

DR. VICTOR A. LOEB. Six hundred and sixteen moths, Pennsylvania and New Jersey; 81 Hymenoptera, United States; 96 Diptera, United States.

WM. M. MANN (Exchange). Twenty-six exotic ants.

F. R. MASON. Moth, Tennessee.

DR. LEVI W. MENGEL. Butterfly, Ecuador.

JAS. MCFARLAND, JR. Two Coleoptera, South America.

J. S MCKENZIE. Four boxes entomological specimens, Nicaragua.

H. A. PILSBRY. One hundred insects, Texas, New Mexico.

PURCHASED. Three hundred Lepidoptera, Paraguay; 143 Hesperidae, Honduras; 207 Hesperiidae, Paraguay. Collection of Orthoptera, Fukien, China.

C. T. RAMSDEN. Seven *Terias*, Cuba.

DR. H. SKINNER. Two hundred and eighty Lepidoptera, Panama.

E. M. SWAINSON. Nineteen Hesperiidae, Jamaica.

M. C. VAN DUZEE. Twenty-three Diptera, United States.

A. B. WALCOTT. Two Coleoptera, Michigan.

H. W. WENZEL. Sixty-three *Donacia*, Pennsylvania and New Jersey.

F. X. WILLIAMS. Seventeen Hymenoptera, Hawaii.

R. C. WILLIAMS, JR. Twenty-one Lepidoptera, Arizona; 6 Exotic Hesperiidae, French Guiana; 18 Hesperiidae, United States.

RECENT MOLLUSCA

DR. W. L. ABBOTT. *Polygyra albolabris* Say, from Henry Valley, Pennsylvania.

W. O. ABBOTT. Two shells from High Point, New Jersey.

A. REGINALD ALLEN. Eight species of shells from Maine and New Hampshire.

DR. FRED BAKER. Three land shells from Brazil.

GEORGE W. BASSETT. *Sphaerium occidentale* Prime, from Hammonton, New Jersey.

BERNICE PAUAHI BISHOP MUSEUM. One hundred and seven trays of Hawaiian land shells.

DR. S. S. BERRY. Thirteen trays of land shells from California.

S. C. BISHOP. Two species of fresh-water shells from Isle au Haute, Maine.

LOUIS H. BREGY. *Gonıobasis nigrina* Lea, from Union Gap, Yakima Valley. Washington.

JAMES B. CLARK. Seventy-five trays of shells from Western America.

H. C. CLAUSEN. Twelve trays of Japanese shells.

T. D. A. COCKERELL. *Geomitra arenicola* Lowe, from east of Canical, Madeira.

MAJ. M. CONNOLLY. *Nothapalus ugandanus* Conn. (part of the original lot).

C. M. COOKE, JR. Five trays of land shells from Vancouver Island.

S. G. CRAMP. *Quadrula schoolcraftensis* Lea, from Pittsford, New York.

PROF. W. H. DALL. *Æsopus chrysalloideus* Cpr., from San Pedro, California.

JAMES M. DELANEY. *Anodontoides ferrussaciana* Lea. from the Erie Canal at Rochester, New York.

EPISCOPAL ACADEMY. Two land shells from the South Pacific.

MISS E. W. EVANS. Two species of marine shells from Camden, Maine.

JOHN FARQUHAR. Two species of *Fauxulus*.

J. H. FERRISS. Two hundred trays of land shells from Arizona.

J. M. FOGG. Five trays of shells from New Jersey.

H. W. FOWLER. Two species of fresh-water shells.

MRS. WALTER J. FREEMAN. A collection of marine shells.

M. GIBSON. A collection of marine shells.

C. GOODRICH. Forty-six trays of fresh-water shells from the Mississippi Valley.

G. D. HANNA (exchange). Seven trays of land shells from California.

GEO. L. HARRISON, JR. *Polygyra albolabris* Say, from Thomasville, North Carolina.

MORGAN HEBARD. Three land shells from New Mexico.

JUNIUS HENDERSON. *Oreohelix depressa* Ckll., from Hardscrapple Draw, Arizona.

MRS. H. S. HOPPER. Five species of marine shells.

WHARTON HUBER. Six trays of shells from Nicaragua.

DR. W. E. HUGHES. Eight trays of land shells from the Fiji and Samoa Islands

INDIAN MUSEUM. Three species of Pupillidae.

E. A. JEFFRIES. A pearl from *Ostrea elongata* Sol., collected at Chincoteague, Virginia.

F. J. KEELEY. Two species of bivalves from Florida.

D C. LEFFERTS. *Physa humerosa* Gld., from twenty miles south of Indio, California.

BAYARD LONG. Seventy-five trays of shells from Nova Scotia and New Jersey.

H. N. LOWE. Forty-one trays of shells from California and Utah.

D. N. MCCADDEN. Three marine shells from the crop of *Marila affinis*.

J. G. MALONE. One hundred and sixty-eight trays of shells.

D. P. MANNIX. *Caecum glabrum* Mont., from Bermuda.

B. C. MARSHALL. *Philomycus carolinensis* Bosc., from Lawrence County, Arkansas.

DR. H. B. MEREDITH. Four species of shells from Virginia.

J. P. MIDDLETON. Eighteen species of marine shells from West America.

J. B. O. MOCKRIDGE. *Patella vulgata* L., from Lizard Head, England.

CLARENCE B. MOORE. Sixty-four trays of land shells from Florida.

L. MOWBRY. *Polypus rugosa* Bosc., from Florida.

T. C. NELSON. *Teredo novangliae* Bart., from Barnegat Bay, New Jersey.

N. H. ODHNER (exchange). Nineteen trays of land shells from Juan Fernandez and Easter Island.

MRS. I. S. OLDROYD. *Pupilla blandi* Mse., from Logan, Utah.

A. A. OLSSON. Ninety-nine species of marine shells from near Havana, Cuba.

LT. COL. A. J. PEILE. Radula of *Marconia margarita* Prest., from Uganda, Africa.

H. A. PILSBRY. Two hundred and twelve trays of shells from New York and Hawaiian Islands.

PURCHASED. Forty-four trays of land and fresh water shells.

J. A. G. REHN AND M. HEBARD. Five trays of shells from California.

SENCKENBERGISCHES MUSEUM (exchange). Sixty-eight trays of *Pupillidae*.

MRS. HELEN STOKES. Collection of marine shells.

D. THAANUM. Twenty-two trays of shells from Japan and the Hawaiian Islands.

U. S. NATIONAL MUSEUM. *Sonorella hachitana* Dall, from New Mexico.

T. VAN HYNING. Thirty-nine trays of shells from Florida.

G. VAN INGEN. *Polita alliacria* Mill., from Poughkeepsie, New York.

PROF. A. E. VERRILL. *Neopetraeus atahualpa* Dohrn, from the Andes of Peru.

DR. BRYANT WALKER. Six trays of land and fresh-water shells from Peru and Alabama.

WARDS NATURAL SCIENCE ESTABLISHMENT. *Achatinella lehuiensis* Gul., from Waianae, Oahu Island.

R. W. WEHRLE. *Polygyra profunda* Say, from Indiana, Pennsylvania.

MISS E. L. WHITAKER. Collection of marine shells.

R. C. WILLIAMS, JR. *Busycon perversa* L., from Corson's Inlet, New Jersey.

WISTAR INSTITUTE. Forty-four trays of shells from Celebes and Borneo.

J. ZETEK. One hundred and twenty-four trays of marine shells from Central America.

OTHER INVERTEBRATES

BERNICE PAUAHI BISHOP MUSEUM. *Chthamalus hembeli* Conr., from Oahu Island.

DR. PHILIP P. CALVERT. Collection of Myriapods and Arachnida, Costa Rica.

J. B. CLARK. Two trays of *Mitella polymerus* Sby., from California.

MRS. E. R. JONES. *Macrocheira kaempferi* De Hav., from Japan.

JOSE LIENHART. Scorpion, Hondurus.

U. S. NATIONAL MUSEUM. Two barnacles from Uruguay.

C. S. WURTS. One *Heliaster* from Nova Scotia.

FOSSILS

JOSEPH MCFARLAND. Invertebrate fossils from New Jersey and Pennsylvania.

H. A. PILSBRY. Two trays of invertebrate fossils from New York.

BENJAMINE C. WARNICK. Mammoth Tusk, Alaska.

PLANTS

G. W. BASSETT. Five hundred specimens from New Jersey; also numerous specimens of cultivated plants.

W. M. BENNER. One hundred specimens, chiefly from Bucks County, Pennsylvania.

O. H. BROWN. One hundred specimens from Cape May County, New Jersey.

I. W. CLOKEY. Four hundred and fifty-five specimens from Colorado.

JOSEPH CRAWFORD. Specimens from New Jersey and Georgia.

MRS. S. W. CREASEY. Specimens of *Sonchus uliginosus*, from Bucks County Pennsylvania.

C. C. DEAM. Four hundred and forty-six specimens from Indiana.

R. R. DREISBACH. Two hundred and twenty specimens from Ohio and Michigan; also 100 specimens from New Jersey and Pennsylvania.

DR. J. W. ECKFELDT. *Callitriche austini*, from Bucks County, Pennsylvania.

MR. W. C. FERGUSON. Three specimens of *Sagittaria* and *Rynchospora*.

M. FOGG, JR. Eight hundred specimens, mostly from southern New Jersey.

DR. H. A. GLEASON. Four hundred specimens, collected by J. S. de la Cruz in British Guiana.

DR. A. A. JONES. Specimens of a cultivated *Solanum*.

A. N. LEEDS. *Caltha* from Pennsylvania; and *Prunus* from New Jersey.

MR. C. D. LIPPINCOTT. *Solidago erecta* from southwestern New Jersey.

BAYARD LONG. Two thousand specimens from Berks and Bucks Counties, Pennsylvania.

K. K. MACKENZIE. *Carex misandroides* from western Newfoundland.

DR. H. B. MEREDITH. Eight hundred specimens from New Jersey, Pennsylvania, and Delaware.

DR. J. C. NELSON. Two hundred specimens from western Oregon.

NEW YORK BOTANICAL GARDEN. Fifty-one specimens, collected by DR. L. Britton in Porto Rico.

REV. J. P. OTIS. Seven specimens from Delaware and Maryland.

T. C. PALMER. Various specimens from Chester County, Pennsylvania.

J. D. U. PLEASANTS. Six specimens from Pennsylvania.

E. A. RAU. Specimens of *Sonchus uliginosus* and *Sisymbrium altissimum*, from eastern Pennsylvania.

GEORGE REDLES. Twenty specimens from New Jersey and Pennsylvania.

LEE SOWDEN. One hundred specimens from Minnewaska, New York.

O. A. STEVENS. *Sonchus uliginosus*; and other new weeds from North Dakota.

DR. R. R. STEWART. Two hundred Scrophulariaceae from northern India.

DR. W. R. TAYLOR. Eight specimens chiefly from Massachusetts and New Brunswick.

MARY H. WILLIAMS. Many specimens from the eastern United States and Bermuda.

MINERALS

SENOR AUGUSTIN ARIAS. Collection Minerals, Cerro de Pasco, Peru.

W. R. FERRIER. Ferrierite.

MICHAEL J. CLANCEY. Gold, Nicaragua.

MRS. WALTER JACKSON FREEMAN. Collection of minerals.
F. LYNWOOD GARRISON. Minerals from China and Nevada.
MISS L. GIBSON. Collection of minerals.
DR. W. W. KEEN. Collection of minerals.
SENOR ADOLFO LAHAYG. Collection of minerals, Llallagua, Bolivia.
J. S. MALONE. Collection of Quartz and Agate pebbles from Oregon.
JOSEPH MCFARLAND. JR. Collection of rocks.
R. A. F. PENROSE, JR. Phosphatic concretion, Sampson Co., S. C.
CHARLES K. SHAW. Collection of minerals of Wm. H. Shaw.
MISS E. L. WHITAKER. Collection of minerals.
PURCHASED. Forty-seven minerals from Franklin, N. J., and Langban, Sweden.
EXCHANGE. Haidingerite, hulsite, ingoite and orientite.

ARCHEOLOGY

MISS GERTRUDE ABBOTT. Dancing-girl's anklet; Chumen-(lime) boxes; little girl's ornament, etc. Celebes.

DR. WM. L. ABBOTT. Natives' mats. Madagascar.

GEORGE W. BASSETT. Stone implements, Phila., Pa., and Cape May Co., N. J.

LYNFORD BIDDLE. Stone implements from "Red-paint graves," Mt. Desert, Me.

CHARLES S. BOYER. Celt, Island of Orchilla, W. I.

MICHAEL J. CLANCEY. Stone and pottery images, stone implements; Nicaragua. Bows, arrows, beadwork ornaments, mat, and bark-cloth blankets of Sumo Indians, Nicaragua.

MRS. WALTER JACKSON FREEMAN. Stone implements, Colorado; Clay figurine; Mexico; Ethnographical material from New Mexico, Alaska, Curacoa, and Tunis; Archaeological material, Carthage.

A. W. GIMBE (in exchange). Arrowheads, Penn.

MISS M. L. HOPPER. Pueblo pottery; ancient sherds and flakes, New Mexico and Wyoming. Roman and Egyptian archeological material.

WHARTON HUBER. Celt, Nicaragua.

DR. W. W. KEEN. Stone implements, Eastern U. S., sherds, Arizona.

J. G. MALONE. Cowry clusters, Africa (?).

DR. JOHN MARSHALL. Tapa, Samoa.

I. P. MIDDLETON. Ancient Peruvian pottery; Roman lamps; shell bracelet, Indonesia; Woodpecker-feather head'bands, California. Etc.

CLARENCE B. MOORE. Archeological material from Florida Keys; printed reproductions of scenes from the Egyptian "Book of the Dead," and illustrations of Mummy-cases.

MISS M. D. POTT. Stone implements, Berks Co., Penn.

CALVERT PRATT. Stone implements, Del. Co., Penn., and Montana.

UNIVERSITY OF WASHINGTON, STATE MUSEUM (in exchange). Stone implements, Washington.

WISTAR INSTITUTE, UNIVERSITY OF PENNSYLVANIA. Upas poison, Celebes.

OTHER MATERIAL

ESTATE OF C. N. PIERCE. Dr. Pierce's microscope and collection of slides.

CHARLES K. SHAW. Refractometer.

SAMUEL G. GORDON. Two mercury-vapor arc lamps, and set of monochromatic filters.

The Ludwick Public Lectures

By its free public lectures the Academy brings nature and the great outdoors to many who have no opportunity to study them first hand. The courses, moreover, draw many visitors to the museum and serve to increase their interest in the exhibits.

The usual courses under the auspices of the Ludwick Institute were given during the winter and early spring months; and we were fortunate in securing the services of several prominent naturalists from other institutions to augment the Academy's staff. All of the lectures were illustrated by colored lantern slides, many of them showing the results of field work by Academy naturalists, and one was illustrated by motion pictures.

About 2600 persons attended the Monday evening course; 1700 the Sunday afternoon lectures; and 1900 the school lectures on Friday afternoon. A course was also provided on local natural history, especially for the Boy Scouts, but little advantage was taken of it.

The Sunday lectures were particularly appreciated and the attendance was large. The lecturers and topics were as follows:

MONDAY EVENINGS JANUARY 9—APRIL 24.

"With the 'Albatross' in the Philippines," Dr. Paul Bartsch.
"Wild Bird Life on Our New Jersey Coast," Dr. Witmer Stone.
"Upland Fishes," Henry W. Fowler.
"Wayside Blooms," J. Fletcher Street.
"The Way of the Sperm Whaler," Dr. Robert Cushman Murphy.
"Backboned Animals," Dr. Spencer Trotter.
"Problems of Insect Life," James A. G. Rehn.
"The Life of a Lake," Dr. Henry A. Pilsbry.
"Cretaceous Dinosaurs," Dr. W. D. Matthew.
"The Southern Alleghanies," Dr. Witmer Stone.
"The Aristocrats of the Plant World," Dr. Francis W. Pennell.
"Lowland Fishes," Henry W. Fowler.
"Bees and Beekeeping," Dr. E. F. Phillips.
"The Economic Aspect of Entomology," James A. G. Rehn.
"The Domesticated Animals," Dr. Spencer Trotter.
"Useful and Injurious Mollusks and Shells," Dr. Henry A. Pilsbry.

SUNDAY AFTERNOONS FEBRUARY 5—MARCH 26.

"Some Days in Japan," Dr. William E. Hughes.
"The Migration of Birds," Dr. Witmer Stone.
"Rare, Strange and Beautiful Shells," Dr. Henry A. Pillsbry.
"Radium, its Sources and a brief Summary of its Characteristics," F. Lynwood Garrison.
"Southern Arizona," James A. G. Rehn.

"A Naturalist in the Santa Marta Region, Colombia," James A. G. Rehn.
"American Bird Types," Dr. Spencer Trotter.
"Natural History in American Zoos," Arthur H. Fisher. (Motion pictures.)

FRIDAY AFTERNOONS (SCHOOL COURSE ON LOCAL NATURAL HISTORY) MARCH 3—MARCH 31

"Some Familiar Birds of the Philadelphia Area," Dr. Witmer Stone.
"Fish Life of the Brook," Henry W. Fowler.
"The Shell-life of our Woods, Streams, and Seashore," Dr. Henry A. Pilsbry.
"Some Insect Friends and Enemies of our Neighborhood," James A. G. Rehn.
"Spring Flowers," Dr. Francis W. Pennell.

REPORTS OF SECTIONS

REPORT OF THE BIOLOGICAL AND MICROSCOPICAL SECTION.—The Biological and Microscopical Section held nine meetings during the year.

In conjunction with the Mineralogical and Geological Section twenty-two excursions were made to localities in Pennsylvania and New Jersey, for purposes of collection, with an average attendance of fourteen members and their friends.

An innovation has been made in the publication of "Contributions from the Biological and Microscopical Section of the Academy of Natural Sciences of Philadelphia," and the first paper is entitled: "New Species of Diatoms," appearing in July.

The Conservator reports the gift to the Section by Mrs. F. H. Easby of the microscope and accessories of the late Dr. C. Newlin Pierce, including a Zentmayer Grand-American stand, numerous oculars and objectives and one hundred and fifty slides.

Communications were made by the following members: Messrs. T. Chalkley Palmer, Hugo Bilgram, F. J. Keeley, Dr. Thomas S. Stewart, Hugh Munro, W. A. Poyser, and Charles S. Boyer.

The following officers were elected for the year 1923:

Director.....T. Chalkley Palmer
Vice-Director.....John A. Shulze
Recorder.....Charles S. Boyer
Treasurer.....Thomas S. Stewart, M. D.
Corresponding Secretary.....Walter Palmer
Conservator.....F. J. Keeley

CHARLES S. BOYER,
Recorder.

ENTOMOLOGICAL SECTION.—The Entomological Section has held all of its stated meetings which have been fairly well attended. Interesting communications and exhibits have been made by several of the members, contributors and visitors. Messrs. John C.

Hollinger, R. H. Hutchison, Arthur D. Whedon, and Frank R. Mason, were elected members.

The following were elected to serve for 1923:

Director.....Philip Laurent
Vice-Director.....Roswell C. Williams
Secretary.....James A. G. Rehn
Treasurer.....Ezra T. Cresson
Recorder.....Ezra T. Cresson, Jr.
Conservator.....Henry Skinner.
Publication Committee: Ezra T. Cresson, Philip P. Calvert and Ezra T. Cresson, Jr.

E. T. CRESSON, JR.
Recorder.

MINERALOGICAL AND GEOLOGICAL SECTION.—Weekly excursions during the Spring and Autumn months, jointly with the Biological and Microscopical Section, afforded opportunities for visiting most of the interesting geological localities in the neighborhood of Philadelphia.

At the annual meeting, the following officers were elected to serve during ensuing year:

Director.....F. J. Keeley
Vice-Director.....T. Chalkley Palmer
Treasurer.....Thomas S. Stewart
Conservator.....George Vaux, Jr.
Recorder.....Samuel G. Gordon

F. J. KEELEY,
Director.

BOTANICAL SECTION.—At a meeting of the Botanical Section held in January last it was decided to dissolve the Section, as the care of the herbarium is so well looked after by the Academy, and the meetings of the Botanical Club fill all needs for furthering the study of local plants.

It is the wish of the Section that the income of the J. H. Redfield Memorial Fund, which now reverts absolutely to the Academy, be used for the purchase of botanical specimens, subject to the direction of the curators.

WITMER STONE,
Treasurer.

ORNITHOLOGICAL SECTION.—The Ornithological Section has encouraged the study of ornithology at the Academy in every way possible. The Delaware Valley Ornithological Club has continued to hold its meetings in the ornithological rooms completing thirty-two years of continued activity at the Academy.

The Pennsylvania Audubon Society and Fairmount Park Bird Club have also met in the lecture hall.

The officers elected for 1923 are:

Director.....Spencer Trotter
Vice-Director.....Samuel N. Rhoads
Recorder.....Julian K. Potter
Secretary.....William A. Shryock
Treasurer and Recorder.....Witmer Stone.

WITMER STONE,
Recorder.

LIBRARY

ADMINISTRATION OF THE LIBRARY

LIBRARY COMMITTEE

WITMER STONE, *Chairman*, F. J. KEELEY
HENRY TUCKER T. CHALKLEY PALMER
SPENCER TROTTER.

SPENCER TROTTER, *Librarian.*
WILLIAM J. FOX, *Assistant Librarian.*

During 1922, the additions to the library total 7,168. The apparent decrease, from the total for 1921, is due to the receipt in the former year of 581 autograph letters of the late S. S. Haldeman, so that there is an actual increase in the accession of books and pamphlets. Pamphlets and parts of periodicals received during the year amounted to 6,270. Of these 717 are volumes, 146 maps, 1 printed sheet, and 34 photographs.

The sources of accession are as follows:

Exchange	3541
Isaiah V. Williamson Fund	2122
United States Department of Agriculture	548
General Appropriation for Purchase of Books	256
Authors	70
Texas Agricultural Experiment Station	47
Pennsylvania Bureau of Topographic and Geologic Survey	46
Mr. Clarence B. Moore	41
Pennsylvania State Library	35
Estate of Frank Thomson	34
Trustees of British Museum (Natural History)	30
Editors	28
New York State College of Agriculture	26
Cornell University Agricultural Experiment Station	21
American Entomological Society	19
Provincial Museum, Toronto, Canada	14
Department of Archives and History, Alabama	13

Museum of the American Indian, Heye Foundation	13
Thomas B. Wilson Fund	12
Zoological and Acclimatisation Society of Victoria	12
Biological Board of Canada	10
New York Agricultural Experiment Station	10
United States Department of Commerce	10
Cuperpo de Ingenieros de Minas del Peru	9
Dr. Henry A. Pilsbry	9
Wyoming State Geologist	9
Queensland Department of Mines	8
Vermont Agricultural Experiment Station	8
Imperial Department of Agriculture of the British West Indies	8
Indiana University	7
Tennessee State Geological Survey	7
State of New York Conservation Commission	7
Department of Agriculture, State of California	6
Florida State Geological Survey	6
Oklahoma Geological Survey	6
Publication Committee of the Academy	6
Geological Survey of Alabama	5
Scripps Institute for Biological Research	5
Statens Skogsförsöksanstalt, Stockholm	5
Argentine Government	4
California Fish and Game Commission	4
Kentucky Geological Survey	4
National Research Council of Japan	4
Virginia Geological Commission	4
Agricultural Experiment Station of Colorado Agricultural College	3
Albert Ier, Prince de Monaco	3
Bristol Museum and Art Gallery	3
Mr. F. Lynwood Garrison	3
Louisiana Commissioner of Agriculture and Immigration	3
Michigan Geological and Biological Survey	3
Roger Williams Park Museum	3
University of Tennessee	3
Utah Agricultural College Experiment Station	3
Dr. William L. Abbott	2
Massachusetts Commission on Fisheries and Game	2
National Academy of Sciences	2
San Francisco Bay Marine Piling Survey	2
Scientific Society of San Antonio	2
Mr. Frederick D. Shelton	2
United States War Department	2
Zoological Society of Philadelphia	2
Biological and Microscopical Section of the Academy	1
Board of Scientific Advice for India	1
Board of Water Supply of City of New York	1

Boston City Hospital	1
Canada. Department of Marine and Fisheries	1
City Library Association of Springfield, Mass.	1
Colorado Mountain Club	1
Colorado Museum of Natural History	1
Danish Government	1
Department of Trade and Customs, Australia	1
Direccion de la Edicion Oficial de las Obras y Correspondencia Cientifica de Florentino Ameghino	1
Estate of Edward J. Nolan	1
Mr. William J. Fox	1
French Government	1
Geological Survey of the Dominican Republic	1
Geological Survey of Georgia	1
Hawaiian Islands Committee of the Press Congress of the World	1
Hercules Powder Company	1
Imperial Entomologist, India	1
Japan Society	1
Messrs. Lemcke & Buechner, New York	1
Louisiana State Museum	1
Michigan College of Mines	1
Ministère des Colonies, Belgium	1
National Research Council	1
New Jersey Department of Conservation and Development	1
New South Wales, State Fisheries	1
New York State Archeological Association, Morgan Chapter No. 1	1
Philadelphia-Interstate Dairy Association Council	1
Philadelphia Museums	1
Rockefeller Foundation International Health Board	1
Society of Economic Geologists	1
South Dakota Geological and Natural History Survey	1
Southwest Museum	1
United States Brewers' Association	1
Warren Academy of Sciences	1

These have been distributed to the various departments of the library as follows:

Journals	5182
Agriculture	739
Geology	561
Botany	143
General Natural History	88
Entomology	79
Voyages and Travels	75
Geography	72
Anthropology	57
Anatomy and Physiology	40

Ornithology	31
Mineralogy	22
Helminthology	15
Conchology	13
Mammalogy	11
Ichthyology	9
Herpetology	8
Bibliography	6
Chemistry	4
Physical Sciences	3
Medicine	2
Encyclopedias	3
Miscellaneous	5

The following new journals and transactions were added to the library either by exchange or purchase:

Academia Aboensis, Abo. Acta, Mathematica et Physicae.
Academy of Natural Sciences of Philadelphia. Special Publication.
Agricultural Bulletin of the Federated Malay States. Kuala Lumpur.
Agricultural Gazette of Canada. Ottawa.
Archives néerlandaises de Physiologie de l'Homme et des Animaux. La Haye.
Asociacion Peruana para el Progreso de la Ciencia. Archivos.
Association of Official Seed Analysts of North America. Proceedings.
Arbeiten des geographischen Instituts der deutschen Universität in Prag.
Arnold Arboretum, Journal.
Australian (The) Naturalist. Sydney.
Botanisches Archiv. Königsberg Pr.
Botanisch-phaenologische Beobachtungen in Böhmen. Prag.
Capita Zoologica. 'sGravenhage.
City Library Association of Springfield, Massachusetts. Annual Report.
Colorado Mountain Club, Denver. Publication.
Commission Internationale pour l'Exploration Scientifique de la Mer Méditerranèe. Bulletin.
Den II. Thule Ekspedition til Gronlands Nordkyst 1916–18.
Dove Marine Laboratory (Northumberland Sea Fisheries Committee). Report.
Globen. Stockholm.
Guam Agricultural Experiment Station. Bulletin.
Hamburgisches Kolonialinstitut, Hamburg. Abhandlungen, Reihe B, C, D.
Imperial Plant Quarantine Station, Yokohama. Bulletin.
Japanese Journal of Botany. Tokyo.
Japanese Journal of Geology and Geography. Tokyo.
Kungl. Vitterhets Historie och Antiquitets Akademien. Handlingar.
Laboratoire de Biologie générale Institut M. Nencki, Prag. Travaux.
Laboratoire Neurobiologique de l'Institut M. Nencki, Prag. Travaux.
Madras Government Museum, Madras. Administration Report.
Malayan Agricultural Journal. Kuala Lumpur.
Museo Nacional de Arqueologia, Historia y Etnografia, Mexico. Boletin.

Natural History Society of Hartford. Transactions.
Naturwissenschaftliche Schriften. Prag.
Nebraska Ornithological Union. Proceedings.
North Carolina Geologic and Economic Survey, Forestry Division. Circular.
Oberösterreichischer Musealverein, Linz. Jahresbericht.
Oberrheinischer Geologischer Verein. Berichte über die Versammlung. Jahres-Berichte und Mitteilungen.
Pan-American Geologist.
Philadelphia Zoological Society. Contributions from Laboratory of Comparative Pathology.
Public Museum of City of Milwaukee. Year Book.
Review of Applied Mycology. Kew.
Revue générale de Botanique appliquée, etc. Paris.
Russian Hydrobiological Journal. Saratov.
San Francisco Bay Marine Piling Survey. Annual Report.
Schweizerische Mineralogische und Petrographische Mitteilungen.
Société d'Histoire Naturelle de l'Afrique du Nord, Alger. Bulletin.
Society of Economic Geologists. Summary of Proceedings.
Southern Ussuri Branch of the Russian Geographical Society. Bulletin. Memoirs.
Stadtische Völker-Museum. Frankfurt a. M. Veröffentlichungen.
State of New York Conservation Commission. Annual Report.
Supplements au Bulletin Biologique de France et de Belgique. Paris.
Topographische Dienst in Nederlandsch-Indië, Batavia. Jaarsverslag.
Union of South Africa Mines Department Geological Survey. Memoirs. Explanation of Sheets. Maps.
United States Department of Agriculture. Pathological Herbarium Notes.
Université de Neuchatel. Mémoires. Theses.
Vermont. Report of State Geologist.
Warszawskie Towarzstwo Politechniczne, Warsaw. Sprawozdania i Prace.
Zeitschrift f. gesamte Anatomie. Abt. III (Ergebnisse der Anatomie und Entwicklungsgeschichte).
Zoologische Berichte. Jena.

A copy of the scarce "An Epitome of the Natural History of the Insscts of New Holland, New Zealand, New Guinea," etc., by E. Donovan, 1805, was acquired by purchase; and a copy of LeMoyne, "Indorum Floridam Provinciam Inhabitatium Eicones," etc., 1591, was received, with other valuable works on anthropology, as a gift from Mr. Charles B. Moore.

Nine hundred and sixty-two volumes were bound and 12 repaired.

Twenty-three volumes and 120 pamphlets, not germane to the Academy's library, were transferred to the Free Library of Philadelphia.

Sixteen hundred and twenty-one volumes were used on premises by the scientific staff; and 221 were borrowed by members.

The Librarian wishes to acknowledge his appreciation of the important and valuable work of Mr. William J. Fox, Assistant Librarian, in the care of the Library; and also of the help constantly rendered by Miss H. Newell Wardle.

SPENCER TROTTER,
Librarian.

PUBLICATIONS

PUBLICATION COMMITTEE

HENRY A. PILSBRY, *Chairman*, WITMER STONE,
WILLIAM J. FOX, MILTON J. GREENMAN, J. PERCY MOORE.
Editor: WILLIAM J. FOX.
Artist: HELEN WINCHESTER.

Owing to a change in the issue of the PROCEEDINGS, from three parts each year to a single volume, which cannot be issued until after January 1, 1923, nothing has been distributed of this publication, except the reprints of the separate papers which are sent out to obtain a date of issue. The volume when completed will contain approximately 310 pages and twenty-two plates.

The ANNUAL REPORTS for 1921, have been issued and distributed to members. They consisted of seventy-four pages and sixteen half-tone illustrations.

Of the ENTOMOLOGICAL NEWS, published by the Entomological Section of the Academy, 333 pages and 11 plates were issued; and the American Entomological Society published 355 pages and 18 plates of its TRANSACTIONS.

Parts 104 and 105 of the MANUAL OF CONCHOLOGY, with 142 pages and 11 plates, have been issued under the editorship of Dr. Pilsbry.

The Academy has published "The Mineralogy of Pennsylvania," by Samuel G. Gordon, a volume of 160 pages and 110 text illustrations, and a frontispiece. This volume forms the initial number of a new series entitled SPECIAL PUBLICATION.

Exchange of publications, interrupted during the world war, has been resumed with correspondents in Roumania, Servia, and Ukrainia; and through the intermediary of the American Relief Administration it was possible to forward to correspondents in Russia, all the publications withheld during the war period.

WILLIAM J. FOX,
Secretary of the Committee.

SECRETARIES

REPORT OF THE RECORDING SECRETARY

During the past year seven meetings of the Academy have been held, six being stated meetings and one an adjourned session to elect members. The dates of the meetings were December 20, 1921; January 17, February 21, March 21, April 18, which meeting adjourned to reassemble at the call of the President, the adjourned session on June 20, and November 21, 1922. The average attendance at the meetings was twenty-two members and twenty-four visitors. Communications were made by Dr. Edwin G. Conklin, Dr. C. Montague Cooke, Henry W. Fowler, Samuel G. Gordon and Wharton Huber.

During the past year thirteen members have died and four have resigned. The losses by death included: Charles Morris, Chairman of the Committee on Accounts of the Academy and a Councilor since 1884, as well as having served at one time as a member of the Committee on Finance, and for many years on the Committee on Instruction; George Spencer Morris, a Curator of the Academy, long a member of the Committee on Instruction, and Councilor for a number of years.

The following were elected members:

Dr. Francis Heed Adler, Miss Alice O. Albertson, Dr. Francis O. Allen, Jr., Dr. Joseph L. T. Appleton, Jr.

Joshua L. Baily, Jr., John Bancroft, Samuel H. Barker, John Hampton Barnes, Leonard T. Beale, Charles Biddle, Commander Clement Biddle, Malcolm H. Bissell, Dr. Theodore W. Bouchelle, Stanley Bright, Joseph H. Bromley, Carolus M. Bromall, William Findlay Brown, Orville H. Bullitt, Miss Martha Bunting.

Miss Sophia Cadwalader, Miss M. H. Cadwalader, Daniel H. Carstairs, John P .Carter, Mrs. Samuel Chew, Clarence M. Clark, Miss M. E. Converse, Henry B. Coxe, Robert M. Coyle, Theodore W. Cramp, James H. R. Cromwell, Samuel M. Curwen.

Charles Day, William D. Disston, Miss Mary A. Dobbins, Col. Franklin D'Olier, Mrs. Franklin D'Olier, Mrs. William Dreer, Mrs. G. W. C. Drexel, Henry S. Drinker, Jr., Irénée du Pont.

Louis H. Eisenlohr, William M. Elkins, William Struthers Ellis, Van Horn Ely, George K. Erben.

Charles Fearon, Thomas T. Firth, N. T. Folwell, Stanley Folz, Frank N. Foster, Mrs. L. Webster Fox, Samuel M. Freeman, Mrs. John Fritsche, Mrs. H. H. Furness, Jr.

John T. Garman, Dr. Arthur Howell Gerhard, Dr. Alfred Gordon, Frank T. Griswold, Dr. Alexander S. Gross, S. R. Guggenheim.

Arthur F. Hagar, Mrs. George L. Harrison, Jr., Frank Hart, William H. Hart, R. Wistar Harvey, Henry Reed Hatfield, William E. Helme, Mrs. Frederick Hemsley, W. E. Hering, Charles E. Hires, George Gowen Hood, Mrs. Samuel F. Houston, John J. Howard, Mrs. H. M. Howe, Mrs. Charles Willing Huber, John F. Huneker, Frederick B. Hurlburt, Miss A. P. Hutchinson, Daniel P. Hutchinson, Jr., Dr. Robert H. Hutchison,

Joseph Y. Jeanes, Dr. Edward M. Jefferys, Edward Hine Johnson, Livingston E. Jones.

Francis Fisher Kane, Dr. Peter M. Keating, Dr. Edward C. Kirk, Rev. Archibald C. Knowles, Gustavus W. Knowles.

Dr. H. Pearce Lakin, Arthur H. Lea, Mrs. Arthur H. Lea, Charles M. Lea, Miss Nina Lea, Elisha Lee, Dr. Henry Leffmann, Howard W. Lewis, Samuel N. Lewis, M. Albert Linton, Miss Caroline Lippincott, Mrs. J. Bertram Lippincott, Horatio Gates Lloyd, Mrs. Horatio Gates Lloyd, Malcolm Lloyd, Jr., Dr. Edward Lodholz, Miss Eleanor Tatum Long, John C. Lowry, Charles H. Ludington.

Dr. Thomas McCrae, Mrs. George D. McCreary, Mrs. Charles J. McIlvain, Jr., Walter S. McInnes.

Percy C. Madeira, Jr., Charles Adsit Magruder, Mrs. John Markoe, John C. Martin, Jules E. Mastbaum, Mathew F. Maury, Mrs. Arthur V. Meigs, Mrs. Richard Waln Meirs, William R. Mercer, Miss H. F. Merrick, Miss Susan S. Miles, Francis F. Milne, Jr., J. Clark Moore, Jr., Dr. L. I. Morris, Samuel W. Morris, Mrs. Samuel W. Morris.

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C. Edgar Ogden.

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Associate Members: Dr. Levi W. Mengel, and Earl L. Poole, both of Reading, Pennsylvania.

Junior Members: Edward P. Bromley, Henry S. Bromley, Jr., Franklin P. Cook, Anne Conrad D'Olier, Franklin D'Olier, Jr., Helen Kitchen D'Olier, Jr., John T. Emlen, Jr., John M. Fisher, Jr., William P. Harrington, Charles Eliot Underdown, George Vaux, X., Henry James Vaux.

By direction of the Council, the second stage of the membership campaign was carried out, with most gratifying success. Two hundred and seventeen members of all classes were added to the rolls of the Academy, which after the death and resignation losses of the year show a net gain of two hundred.

In appreciation of their monetary gifts to the Academy for general or special purposes, by action of the Council, Mr. Clarence B. Moore

was designated a Benefactor, and John Cadwalader, Mrs. Samuel G. Dixon, Morgan Hebard, Effingham B. Morris, and Mrs. Beulah M. Rhoads, as Sustaining Members.

The Recording Secretary desires to express his appreciation of the cordial assistance and helpful suggestions given by officers and councilors of the Academy, during a year crowded with irksome routine details. It is a distinct pleasure to realize that the Council of the Academy has authorized the inauguration, in the near future, of a Central Office, which will relieve the Secretaries and other officers of the Academy of much purely clerical routine, which now consumes time of far greater value to the Academy.

JAMES A. G. REHN,
Recording Secretary.

REPORT OF THE CORRESPONDING SECRETARY

Correspondents deceased during the year are H. R. H. Albert I, Prince of Monaco, and Alfred Goldsborough Mayor. No correspondents were elected.

Among important scientific activities in which the Academy was invited to participate were: the semicentennial of the founding of the museum of the Ethnological Society of Leipzig; the one hundred and fiftieth anniversary of the founding of the Royal Belgian Academy; the twenty-sixth annual meeting of the American Academy of Political and Social Science; the national committee to found a Spencer F. Baird memorial, on which Dr. R. A. F. Penrose, Jr., was appointed as the Academy's representative; the Thirteenth International Geological Congress at Brussels, to which Dr. Penrose also went as the Academy's delegate; the Twentieth International Congress of Americanists at Rio de Janeiro, at which the Academy was represented by Dr. William P. Wilson; a proposed memorial foundation at Brussels to Maurice Rahir, in the form of a prize to be awarded for distinguished geographical discovery; the seventieth birthday jubilee of Victor Goldschmidt; and the inauguration of Marion Edwards Parks as President of Bryn Mawr College. In cases where the Academy was unable to appoint a delegate, congratulatory letters, or suitable acknowledgments, were sent.

A handsome bronze medallion, commemorating the one hundred and fiftieth anniversary of the Royal Belgian Academy of Sciences, Letters and Fine Arts, was received.

The usual routine correspondence and exchange of courtesies were conducted.

Statistics of correspondence follow:

Communications received:	
Acknowledging the receipt of the Academy's publications	169
Transmitting publications to the Academy	59
Requesting exchanges or the supply of deficiencies	67
Photographs of correspondents	2
Invitations to learned gatherings, etc	14
Notices of deaths of scientific men	3
Circulars concerning the administration of scientific and educational institutions, etc	24
Letters from correspondents and miscellaneous letters	103
Total received	443
Communications forwarded:	
Acknowledging gifts to the Library	1202
Requesting the supply of deficiencies in periodicals	438
Acknowledging gifts to the Museum	146
Acknowledging photographs and biographies of correspondents	2
Letters of sympathy or congratulations, addresses, etc	16
Diplomas of correspondents and delegates' credentials	3
Miscellaneous letters	177
Annual Reports	280
Total forwarded	2264

J. PERCY MOORE,
Corresponding Secretary.

CENTRAL OFFICE

Bursar: Florence E. Franck.

TREASURER

SUMMARY OF THE ACCOUNTS OF GEORGE VAUX, JR., TREASURER OF THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, FOR THE FISCAL YEAR ENDING NOVEMBER 29TH, 1922.

GENERAL FUND

RECEIPTS

Balance on hand 30th November, 1921	$ 2,057.31
Income from Investments	45,107.49
Income from the Estate of John Turner	150.48
Annual Dues	3,786.00
Interest on Bank Balances	580.39
Publications sold	434.96
Account of 1309 Arch Street,-Cancellation of Insurance Policies	86.75
Transfer from Special Funds:—	
Jeanes Fund for Museum Expenses	950.00
Wilson Fund for Librarian's salary	400.00
	$53,553.38

PAYMENTS

General expenses, including fuel, light, water and building repairs	$ 4,876.89
Salaries in Curators' Department	31,946.10
Museum Cases	811.99
Specimens and Expeditions	1,015.38
Salaries in Librarian's Department	2,274.92
Librarian's expenses	124.46
Books	1,453.62
Binding	1,501.70
Petty expenses	350.00
Printing Proceedings	2,376.30
Mineralogy of Pennsylvania	1,770.25
Recording Secretary, salary and expenses	1,496.02
Corresponding Secretary's expenses	50.00
Expenses of Treasurer's Department	430.00
Mary S. Warren, on account of 1309 Arch Street	1,800.00
Estate of Robert H. Lamborn, deceased, for taxes, etc. on lands in Colorado and Minnesota	800.00
Balance on hand 29th November, 1922	475.75
	$53,553.38

CONCHOLOGICAL SECTION FUND

RECEIPTS

Net Income collected	$1,264.30
	$1,264.30

PAYMENTS

Balance overdrawn 30th November, 1921	$ 912.37
Balance on hand 29th November, 1922	351.93
	$1,264.30

COPE COLLECTION FUND

RECEIPTS

Balance on hand 30th November, 1921	$3,147.98
Net Income collected	782.87
Balance on hand 29th November, 1922	$3,930.87

F. V. HAYDEN MEMORIAL FUND

RECEIPTS

Balance on hand 30th November, 1921	$ 51.23
Net Income collected	102.22
Balance on hand 29th November, 1922	$153.45

HORACE N. POTTS FUND

RECEIPTS

Balance on hand 30th November, 1921	$475.32
Net Income collected	304.02
Balance on hand November 29th, 1922	$779.34

MARY JEANES MUSEUM FUND

RECEIPTS

Balance on hand 30th November, 1921	$ 83.79
Net Income collected	870.70
	$954.49

PAYMENTS

Transferred to General Fund for Museum Expenses	$950.00
Balance on hand 29th November, 1922	4.49
	$954.49

JESSUP FUND, MALE BRANCH

RECEIPTS

Balance on hand 30th November, 1921	$ 504.55
Net Income collected	630.03
	$1,134.58

PAYMENTS

Salaries to Students	$1,125.00
Balance on hand 29th November, 1922	9.58
	$1,134.58

JESSUP FUND, FEMALE BRANCH

RECEIPTS

Balance on hand 30th November, 1921	$ 92.49
Net Income collected	222.86
	$315.35

PAYMENTS

Salaries to Students	$240.00
Balance on hand 29th November, 1922	75.35
	$315.35

J. A. MEIGS LIBRARY FUND

RECEIPTS

Net Income collected	$ 520.70
Balance overdrawn 29th November, 1922	570.38
	$1,091.08

PAYMENTS

Balance overdrawn 30th November, 1921	$1,067.24
Books purchased	23.84
	$1,091.08

J. H. REDFIELD MEMORIAL FUND

RECEIPTS

Balance on hand 30th November, 1921	$456.36
Net Income collected	172.61
	$628.97

PAYMENTS

Purchase of pressed plants, etc	$ 88.54
Balance on hand 29th November, 1922	540.43
	$628.97

MARY REBECCA DARBY SMITH FUND

RECEIPTS

Balance on hand 30th November, 1921	$184.53
Net Income collected	71.52
Balance on hand 29th November, 1922	$256.05

AUBREY H. SMITH FUND

RECEIPTS

Balance on hand 30th November, 1921	$2,481.16
Net Income collected	735.52
Balance on hand 29th November, 1922	$3,216 68

FRANCIS LEA CHAMBERLAIN FUND

RECEIPTS

Balance on hand 30th November, 1921	$591.21
Net Income collected	110.83
Balance on hand 29th November, 1922	$702.04

THOMAS B. WILSON FUND

RECEIPTS

Balance on hand 30th November, 1921	$ 97.98
Net Income collected	489.83
	$587.81

PAYMENTS

Books Purchased	$185.00
Transferred to General Fund for Librarian's salary	400.00
Balance on hand 29th November, 1922	2.81
	$587.81

WILLIAM S. VAUX FUND

RECEIPTS

Balance on hand 30th November, 1921	$ 835.08
Net Income collected	526.50
	$1,361.58

PAYMENTS

Minerals purchased	$ 720.84
Balance on hand 29th November, 1922	640.74
	$1,361.58

I. V. WILLIAMSON FUND

RECEIPTS

Net Income collected	$1,840.26
	$1,840.26

PAYMENTS

Balance overdrawn 30th November, 1921	$ 115.30
Books purchased	1,476.74
Balance on hand 29th November, 1922	248.22
	$1,840.26

SPECIAL DONATION FUND

RECEIPTS

Balance on hand 30th November, 1921	$ 521.33
Donations received	4,809.00
	$5,330.33

PAYMENTS

Purchase of Cases, Expeditions, etc	$3,134.75
Balance on hand 29th November, 1922	2,195.58
	$5,330.33

J. F. BEECHER MEMORIAL LABRATORY FUND

RECEIPTS

Balance on hand 30th November, 1921	$3,170.66
Net Income collected	889.41
Balance on hand 29th November, 1922	$4,060.07

GENERAL ENDOWMENT FUND

RECEIPTS

Balance on hand 30th November, 1921	$553.46
Net Income colletced	179..68
Balance on hand 29th November, 1922	$733.14

Respectfully submitted,

GEORGE VAUX, JR.,
Treasurer.

E. and O. E.
Philadelphia,
December 1st, 1922.

We herewith report that we have made an audit of the books and accounts of George Vaux, Jr., Esq., Treasurer of the Academy of Natural Sciences, Philadelphia, Pa., for the fiscal year ended November 29th, 1922.

As the result of our audit we certify that these statements are in accord with the records of the Girard Trust Company, Agent, and with the Treasurer's books, respectively, and are in our opinion correct.

All of the income received during the year was accounted for and entered upon the books. The payments, as shown by the Cash Book, were properly supported by statements, checks or vouchers and were found to be correct. A reconcilliation of the deposit account with the Girard Trust Company was made by us and the correctness of the Cash Balance as shown by the Treasurer's books verified thereby.

(Signed) EDWARD P. MOXEY & Co.
Certified Public Accountants.

REPORT OF THE TREASURER OF THE MANUAL OF CONCHOLOGY

The Treasurer of the "Manual of Conchology" respectfully reports that during the year ending December 1, 1922, the receipts from all sources were:

.....	$1,738.60
And disbursements.....	643.14
Leaving a balance.....	1,095.46
Adding to this, balance Dec. 1, 1921.....	519.48
Leaves balance, Dec. 1, 1922.....	$1,614.94

The receipts were as follows:

From Manual subscriptions, Vol. XXV.....	$ 6.40	
" Manual subscriptions, Vol. XXVI.....	542.03	
" Manual subscriptions, Vol. XXVII.....	257.90	
" Sale, back vols. and parts.....	917.48	
" Interest, daily Bank Balances.....	14.79	
		$1,738.60

The disbursements were:

Colorists.....	$ 45.00	
Lithographing plates.....	60.18	
Paper and printing.....	398.42	
Binding parts.....	37.63	
Postage, expressage, etc.....	40.91	
Advertising.....	4.00	
Transfer from deposit account, Wm. Wesley and Son	57.00	
		643.14
Balance on hand.....		$1,614.94

The balance on hand is subdivided as follows:

For Manual of Conchology..... ..... $1,594.69
Wm. Wesley and Son, Deposit subject to demand..... 19.25

The editorial services and the expenses incurred in draughting plates, continue to be assumed by the Publication Committee of the Academy.

Respectfully Submitted,

S. RAYMOND ROBERTS,
Treasurer.

December 1, 1922.

Examined and found correct,
R. C. WILLIAMS, JR.

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